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THE NEW SESSION, 1914–15.*

By DOUGLAS W. FRESHFIELD, President.

It has been the custom, I believe, for your President at the opening meeting to refer to the geographical events of the past vacation, and to give some details as to the papers that may be laid before the Society during the session. But to-day there is one subject that is in, that presses on, all our minds, the subject that you have come to hear about to-night, and I shall therefore deal but briefly with other matters.

At any other time, the fact that the ship containing the members of Sir E. Shackleton's expedition to the Weddell sea left Buenos Aires on October 26 would have been widely and sympathetically noted. Sir Ernest's programme, as we all know, is a very bold one; he means to endeavour to cross the Antarctic continent, and for this purpose he has sent a second ship and party to the Ross sea in the hope that a meeting may be effected somewhere in the heart of Antarctica. The difficulties and dangers of his plan have been fully put before Sir Ernest, and he has, I understand, made all possible preparations for meeting them. Should he succeed, he will probably solve several outstanding problems as to the extent and unity of the lands round the South Pole. Sir Ernest carries with him our best wishes in his hardy adventure. We trust he may come home to find his country at leisure to do honour to his exploits; but he will come home to a changed world. It is, however, an ill wind that blows nobody good! Sir Ernest will probably have a free hand to land where he likes in the Weddell sea free from any risk of interference with the once contemplated Austrian expedition to the same coast.

Next to Sir E. Shackleton's in importance comes the scientific Italian expedition led by Dr. de Filippi into the Karakoram. It has carried out

* Royal Geographical Society, November 9, 1914.

its very varied programme with wonderful completeness. Topographic surveying forms only a part of its work; a large amount of careful mapping has, however, been done, and our knowledge of those enormous ranges has been greatly enlarged. Amongst other points the source of the Yarkand river has been located in a vast ice-field, one branch of which also feeds a tributary of the Indus. Dr. de Filippi is returning to Europe shortly, and we may hope to see him here.

We have so far heard nothing of the departure of Captain Amundsen's projected expedition to the Arctic, to the proposals for which we gave our support when they were laid before the Society four years ago.

From Sir Aurel Stein we may hope for details with regard to his latest explorations in the Chinese borderlands—explorations which are sure to be full of interest both to the geographer and the archæologist. No traveller has added more to the prehistoric study of Central Asia.

From Arabia Miss Gertrude Bell and Captain Shakespear had returned before the end of last session, both with stories to tell of that fascinating and mysterious region now brought within the sphere of active politics. Captain Shakespear, unfortunately, has had to return to his post on the Persian gulf, but we hope to have the pleasure of listening to Miss Bell before Christmas.

Mr. Walter Weston, who has a unique knowledge of that fascinating district, where I was last year, the Japanese Alps, is returning from his prolonged residence in that country, and will no doubt give us a paper. He is, I believe, the only clergyman of the Church of England who has received preferment in the shape of being enshrined as the local deity of a mountain peak.

In Russia Mr. Harold Raeburn has completed, after several seasons, his investigations of the intricate orography of one of the finest groups of the Central Caucasus, and should have something to tell and show us.

In the New World, in South America, United States professors have been busy. Prof. Hiram Bingham and his party are continuing their work in Peru; Prof. Isaiah Bowman has published a summary account of the results of his work in the borderlands of Bolivia, Chile, and the Argentine; Dr. Farabee has made his way across from the Amazon to Georgetown, British Guiana, through some of the least-known districts on the borders of Brazil and Guiana.

By the death in the field of Major Toppin, a member of the Bolivia-Peruvian Boundary Commission, we lose a paper on the geographical results of the Commission.

Bad news has been received from the expedition under Mr. Stefansson for the discovery of new land to the north of the Canadian Archipelago. It is feared that at least eight members of the expedition have been lost, including Mr. James Murray and Dr. Forbes Mackay, both of whom have served in the Antarctic.

Such are the principal among what I may call the ordinary events of the past summer. But we meet to-night among extraordinary events, so extraordinary that there are signs their character is not yet fully realized by some of our countrymen. We must have many of us turned over prints of a hundred years ago, showing the troops in Hyde Park; or read De Quincey's description of the coaches wreathed with laurels that carried through the country the news of Wellington's latest Peninsular victory; or enjoyed in Mr. Hardy's 'Trumpet-Major' the authentic "Address to all ranks and conditions of Englishmen," in which our ancestors were exhorted in vigorous terms to defend their country from "an implacable enemy, who like a destructive pestilence has laid waste and destroyed everything that before was fair and flourishing." But little did we dream that we should live to see tents and horse-lines in the London parks and on every common; darkened streets; khaki in the law-courts and even in the solemn precincts of the Athenæum; that we should have our horses and motor cars requisitioned, our houses turned into hospitals, and our days darkened by losses, personal and national and universal, so great as to be almost unimaginable. Yet even these portents seem hardly to have brought home to the nation as a whole the nature of the crisis in our history.

We are living from day to day in the heart of the greatest war that has ever been fought, a war that spreads across Europe and touches the farthest bounds of Asia and Africa, that involves every ocean and echoes even among the scattered, far-off beaches of the Pacific; a war in which the issue is between on one side right and honour, and on the other brute force driven by an ambition that knows no law; a war in which the stakes Great Britain is playing for are victory, or destruction at the hands of a foe whose deeds and words, whose burnings and brutalities, have revolted the conscience of humanity, and won for the Allies the sympathy of the civilized world.

At such a time it may be asked whether we should continue our ordinary meetings and discussions. It may be difficult to feel our usual interest in the details of discovery and science. But in my judgment the proper course—for those of us who cannot fight—is to follow our business and the pursuits in which we are experts, and to keep up our habitual interests with all the energy and cheerfulness we can muster. We should try to imitate, I will not quote the classical instance, the Roman Senate before the Gauls, but let me say the more recent example of a branch of the French Institute that discussed Cyprian coins while the Uhlan was at Senlis and Chantilly. Fortunately, the barbarians are not yet at our doors.

In the case of our Society the present crisis calls on us, more than on most, not only to keep up, but to add to, our normal activities. More than ever in time of war and the revision of frontiers that must follow war, ought we to persist in our endeavours to distribute geographical facts and to inculcate the right way of grouping and dealing with them. For war and geography are closely connected. A grasp of the features of the country, the right maps and intelligence to use them, are among the first requirements of a soldier. That was a lesson we learnt—at great cost—in the Boer war. Of the three requisites Napoleon laid down for carrying on a successful campaign, the first was a knowledge of the geography of the seat of war. Sir John French's despatches show in a very marked degree this invaluable topographical sense, and we may feel sure there is no lack of it to-day among our officers.

I am glad to be able to say that the Society has in this respect been able to be of some use to the forces in the field. At the outset of hostilities the entire services of our staff were placed at the disposal of the War Office. They were cordially accepted and fully used. For several weeks work, which employed not only the regular staff but a number of volunteers, went on at Lowther Lodge. This work is still going on. Much of it has been brought to completion and put into use in the field, and we have received through Colonel Hedley very satisfactory testimony to the help it has given His Majesty's forces both on land and in the air.

DR. DE FILIPPI'S ASIATIC EXPEDITION.

Dr. F. de Filippi sends from Suget Karaul (Chinese Turkestan) the following account of the further scientific work of his expedition, from April 7 to the end of August, dated August 13, 1914.*

On April 7, after completing the geophysical observations of the Leh station, Commander Alessio, Prof. Obetti, Marchese Ginori, and the guide Petigax, left for Moré, on the Rupshu plateau, carrying the whole scientific equipment. I have mentioned before that we had decided to make a gravimetric station at Moré, although far out of our itinerary, because of the desire expressed by the Survey of India that the pendulum observations made at that spot in 1871 by Captain J. P. Basevi, with singular and unaccountable results, should be repeated. Although the pass leading on to the Rupshu (17,400 feet) was deep under snow, all the information obtainable at Leh had led us to believe that the plateau itself would be almost entirely free from it. When the party reached the pass, not without difficulty, a track having been previously made through the snow for the laden coolies, they saw to their dismay the whole vast tableland covered by a thick layer of snow, through which not a rock protruded. To proceed with the heavy baggage through 25 miles of deep soft snow was out of the question, and to beat a track through it seemed equally impracticable, so Commr. Alessio decided to give up the attempt and to return to Leh. A few days later Professor Dainelli also returned after

* See *Geographical Journal*, vol. **43**, pp. 32 and 672.

nearly a month's absence. He had gone up the Indus valley as far as Chumatang, whence he reached the Rupshu plateau in order to study its geology and morphology, which are particularly interesting owing to the glacial erosion, the closed basins, the salt lakes, etc. He found there winter conditions, a large amount of snow, and lower temperatures than he had experienced in the upper Baltistan valleys in December and in January. He then came back to the Indus valley, and followed it upstream to the Tibetan frontier. On the way back he skirted the Pangkong lake, and returned to Leh by the Vankse and Chang La road. In the latter portion of his journey Prof. Dainelli had also the opportunity of studying the anthropological characters of the Changpa nomad people in their winter quarters.

On April 29 we were joined by the second batch of members of the expedition: Prof. O. Marinelli, geologist; Prof. C. Alessandri, meteorologist; Major H. Wood, R.E., of the Survey of India; Mr. A. J. Spranger, topographer; and two surveyors, Jamna Pershad and Shib Lal, also of the Survey of India.

During the first half of May, the geologists made an excursion in the Zanskar district to investigate the Himalayan Tertiary. In the Leh district, besides making anthropological investigations, they ascertained the presence of considerable moraine depôts, the remains of a past glacial period.

During our stay in Leh, meteorological readings, pilot-balloon ascents and solar-radiation observations with Ångström pyrheliometer were regularly made.

At last, on May 15, the whole expedition started for the Karakoram, by the new road which is mentioned in the last report. On the fourth day we crossed the Kilas range over the Chang La (about 18,000 feet) in snowy weather, and next day we reached Shyok, a small village 12,100 feet high, the last inhabited place that we were to see for a long time.

We then went up the Shyok valley for eight days. The broad valley has a gentle slope, and is deeply cut between the Sasir range and the Chang-Chen-Mo and Lingzi Chang tablelands. Major Wood, Mr. Spranger, and the surveyors carried on a survey of the road while we marched up the valley. The snow and glacier melting had hardly begun yet, and the river was easily fordable, so that we were able to proceed along the flat stony bottom of the valley, and were spared the tiring ups and downs of the track which runs along the left bank of the river. Even so, the poor transport ponies and yaks suffered a good deal, owing to the lack of pasture. Fortunately we were able to replace some of them which became unable to proceed with picked animals from the caravans which we met on their way back from Depsang, where they had carried our supplies.

On May 30 we turned off from the main valley into deep and narrow gorges down which rushes a swollen and violent stream, and we arrived at the camping-place Murgo, where the new road joins the old Nubra-Sasir road. Two more stages brought us to Kisil Langur, a short distance from the edge of Depsang, where all our supplies had been collected at the foot of a cliff, because the Depsang had been entirely covered with snow until a few days before.

The next day, June 2, we pitched our camp in the western and higher portion of the Depsang plateau, by the side of a small rivulet, the only permanent stream of the plains. This camp, at 17,500 feet altitude, formed our base for two and a half months. We had arrived there at the most favourable moment. Wide stretches of ground were still covered with snow or soaked with water, and a few days earlier we should not have found a dry spot on which to pitch our tents; while on the other hand, a short delay would have brought with it swollen and dangerous waters on our way up.

The Depsang is a huge terrace, swept by the winds day and night, covered with pebbles and minute detritus, entirely bare of vegetation. The Karakoram-Turkestan road runs through it, marked by a line of bones, skeletons, and carcases of horses, donkeys, and camels over which prey flocks of large ravens. In this abode of desolation Prof. Alessandri and Marchese Ginori spent two and a half months, collecting meteorological data, experimenting with pilot balloons, following them in their course with two theodolites at the ends of measured bases of various lengths, and observing solar radiation with Ångström pyrheliometer. Marchese Ginori also received the wireless time signals which were transmitted from Lahor twice a week for the regulation of our chronometers.

June was entirely taken up with the transport of supplies from Kisil Langur to Depsang, and from here to the advanced depôts for the survey parties. Meanwhile Commr. Alessio and Prof. Abetti completed the geophysical station, and Major Wood, with Mr. Spranger and the surveyers, remapped the plateau and the surrounding valleys, which are very inaccurately drawn on existing maps.

On June 11 Profs. Marinelli and Dainelli departed on a month's excursion to the upper Kara Kash and to the closed basins of the Lingzi Thang plateau. Their itinerary is partly through entirely unknown land. They made interesting observations on the morphology of the lake basins, and on the extent to which deposits had been carried eastward by the ancient Karakoram glaciers, and especially on the geology of this region, where rich fossiliferous deposits were found extending from the Palæozoïc to the Cretaceous.

About the same time Dr. de Filippi, with Major Wood, Lieut. Antilli, Mr. Spranger, and the guide Petigax, made a preliminary excursion to the front of Remo glacier, for topographical purposes and to find a way up to the glacier.

The real exploration work began on July 1. Our aim, according to the original plan, was to ascertain the position of and to survey the Indo-Asiatic watershed between the Siachen glacier and the Karakoram pass. The Survey of India map of this district, drawn from sketches made in 1864–66 by Johnson, shows to the east of Siachen a group of glaciers which do not flow beyond the confines of the valleys where they originate. To one of these glaciers the name of "Remo" is given. In 1909 Dr. E. G. Longstaff, after completing the exploration of the Siachen, went up the Shyok river to its source and was much impressed by the appearance of the glaciers from which it springs. He was the first to surmise their importance and size, and the present exploration was entirely due to his advice and information. The results have quite justified his previsions.

The exploration was carried out by two separate parties. Major Wood, with Mr. Spranger and the surveyor Shib Lal, undertook the survey of the southern and northern aspects of the watershed between the Remo basin and the Karakoram pass; Dr. de Filippi, Commr. Alessio, Prof. Abetti, and Lieut. Antills, with Jamna Pershad and Petigax, went directly to the Remo glacier. There was some delay due to the difficulty of crossing the large and swift glacier streams and to a snowstorm which lasted two days, so that it was not until July 11 that the party actually climbed on to the glacier.

It took us one month to survey it, and we were greatly hampered by an unexpected obstacle—the persistent bad weather which prevailed over a vast area of the country through most of July and part of August. Notwithstanding this, Lieut. Antilli was able to secure a good number of photographic plates and panoramas, which will sufficiently illustrate the Remo. The glacier offers no difficulty whatever, and on our way up, before the advent of bad weather, we found it entirely free from snow up to the higher basins. The snow caught us in the high camps, at an altitude of 19,000 and 19,300 feet, near the upper circus of the largest branch of the glacier, and kept us there for eleven days, until the conditions, growing daily worse, forced us to a hasty return. Many of the coolies, although warmly clad, were frostbitten, some got snowblind, and each day the number of the invalids increased. The glacier was so much changed that it took us nearly ten hours to cover a distance that we had gone up thirteen days before in about five.

Profs. Marinelli and Dainelli, back from the Lingzi Thang, paid a visit to the Akfash and Kundan glaciers, which protrude from their valleys right across the Shyok, and have entirely closed the old Turkestan road. They found these glaciers practically unchanged since Longstaff's visit in 1909. They then traversed the whole of the Remo basin, and left it by a pass leading east, to the upper Yarkand river and the valleys explored by Major Wood's party. They then returned to Depsang over the Karakorum pass.

On August 13 the whole expedition was again united at the Depsang camp. In spite of the complications arising from the splitting up in so many parties, all the arrangements made for the transport, the supplies, etc., worked without the slightest hitch.

The exploration has proved the watershed range, the position and direction of the valleys, and the distribution of the glaciers to be entirely different from the representation in modern maps. The river Shyok originates from a single vast glacial basin, to which we have left the name Remo, although it is unknown to natives and has no meaning in any of the local languages. The Remo is formed by two large glaciers, a western and a northern one, which meet nearly at a right angle at the bottom of their valleys, and end at about 16,000 feet of altitude with a single common front, 300 feet high, which fills the whole width of the Shyok valley. These glaciers are 22 to 24 miles long, 2 to 5 miles broad; and the total area of the basin is about 240 square miles. To the east of the Remo the glaciers suddenly disappear, except for some insignificant single icefields, which makes the presence of such a vast glacial basin at the extreme limit of the Karakoram zone covered with ice all the more remarkable.

Both the western and the northern valleys are very wide, and rise with a very gentle slope up to the upper basins. The lower portion of the glaciers for several miles is thickly covered with huge ice pyramids and pinnacles of dazzling white, which at first may be taken for séracs, but which are only the result of melting. The geologists have observed similar formations, on an even bigger scale, on the Aktash and Kumelan glaciers.

The western Remo leads up to a vast amphitheatre of imposing mountains. The northern Remo, which is the larger of the two glaciers, flows between ranges not very high nor very impressive. It rises northward for about six miles, up to a sort of circus, where it bends to the north-east, to reach at 19,700 feet of altitude a basin so vast and so even that it has the appearance of a plateau. The glacier fills it to the brim, and appears to overflow between peaks which stand alone like islands in the ice. One of the cols, to the west, communicates with the Siachen basin, another, to the north, is on the watershed. It is much to be regretted that the persistent bad weather and the large quantity of newly fallen snow prevented us from actually reaching either of these saddles.

Into the northern Remo, or rather into the circus noted above, where the valley bends up to the north-west, flows a large tributary glacier from the north-west, which we followed up to the watershed ridge. This tributary, shortly before its termination in the Remo, bifurcates, and sends a short, but wide and thick, tongue through a deep cleft in the range to the other side of the watershed.

This singular fact becomes even more interesting through the result of Major Wood's exploration. Through a saddle to the west of Karakoram pass Major Wood and his party had entered a large basin of confluent valleys, which he identified as connected with the Yarkand river. The search for its sources had led him directly to this same tongue of the Remo glacier, and at the same time had given them the opportunity of connecting the survey work with ours. The small lake which Hayward, in 1868, thought to be the source of the Yarkand is about 15 miles from the glacier, and has practically no part in the feeding of the river.

We have thus ascertained the most remarkable fact of one and the same glacier, the Remo, giving rise to the Shyok river, a tributary of the Indus, and to the Yarkand river, whose waters end in the deserts of Central Asia. This is only an instance of the general uncertainty of the watershed which we have encountered in the whole region, and which no doubt is intermediate between an ordinary range and the hydrographical conditions of the closed basins and indifferent watersheds of the Tibetan plateaus.

The Yarkand river, a few hundred yards below its origin, receives an important tributary which comes from a glacier overriding a saddle, and draining on both sides of it. Lower down the valley spreads out in a vast circus, where several tributaries join it. Major Wood went down-stream for about 60 miles, and ascertained the existence of two considerable western tributaries, which must flow from the northern slopes of the Karakoram, and which will be the object of the next exploration.

We had been several weeks without any news of the world, owing to an interruption of the road in the Shyok valley, when, on August 16, we received five European mails and, from India, the dramatic news of the conflagration which had broken out in Europe. England and Italy were said not to be entangled in it. Commr. Alessio and Lieut. Antilli thought it to be their duty to return at once to Italy, and Prof. Alessandri (an officer in the reserve), who had anyhow finished his work in the expedition, decided to join them. They left the next morning for Leh, intending to sail from Bombay. Their departure is a serious loss to the expedition, but we hope to finish our whole programme of work. Major Wood replaces Commr. Alessio as second in command of the expedition.

On August 19 a transport caravan of sixty camels and fifty horses, collected for us among the Kirghizes of Shahidula and Suget, arrived at the Depsang, and next day we left with all our things to cross the ranges into Chinese Turkestan. After crossing the Karakoram pass we again split up. Mr. Spranger with Petigax and the surveyors continued down to the Yarkand valley, taking with him most of the supplies. The rest of the expedition with the scientific baggage crossed the Suget pass (17,600 feet) and came down to the small Chinese fort at its foot, in the Kara Kash valley (13,000 feet).

Here, on the 26th, our party was further reduced by the departure of Profs. Marinelli and Dainelli, who returned home by way of Kashgar and Russian Turkestan. We are at present engaged in completing the geophysical station. We had little hope to receive at this place the wireless time signals of Lahore, owing to the distance and the number and bulk of intervening ranges; but they are perceived very distinctly every evening. The pendulum observations have just been brought to a successful close. There remain to be done the magnetic observation and the topography of the place. All these researches are now entrusted to Prof. Abetti, with the assistance and help of Major Wood and of Marchese Ginori.

We shall leave Suget on September 4, and cross into the Yarkand valley over the Kirghiz Dawan. Major Wood will then go up-stream and join Mr. Spranger at Kufelang, to complete the exploration of the upper branches of the Yarkand. Dr. de Filippi, Prof. Abetti, and Marchese Ginori will follow the valley down-stream, and cross the Aghil range to explore the Oprang valley. Towards the end of October the expedition will be again united in the town of Yarkand, and will make the remaining geophysical stations according to the original plan.

THE GULF STREAM.*

By Commander W. W. CAMPBELL HEPWORTH, C.B., R.D., R.N.R.

1903 (Fig. 10).

Sea temperature, in the south-western portion of the North Atlantic represented by the 70° isotherm was above the normal in January, February, and March, and was below but increasing to the north-east. After March the sea temperature quickly declined except about the 50th parallel, where the 60° isotherm was well to the east of its average limit until after April. It exhibited fluctuations during the remainder of the year, but, except in the south-west arm of the ocean, continued chiefly below the average during the remainder of the year.

Air temperature at the three representative stations, above the normal until March, fell below in April, and remained below for the most part until the close of the year, except at Shields in October, when it was above in that month.

1904 (Fig. 11).

Sea temperature below the average in January and February, increased in March and April, then diminished, the 60° isotherm receding at least 11° west of its average limit at the end of June. After November sea temperature was not far from the normal, the 60° isotherm having been considerably to the east of the normal in September to November inclusive.

Air temperature at the three stations rose and fell as a rule in response to changes in sea temperature, but lagged markedly. Associated with the rise in the temperature of the latter, air temperature at Shields rose to nearly 3·5° above the normal in April and continued above until August.

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* Continued from p. 452. The last sentence of the preceding instalment, p. 452, should read, "The salient features exhibited in each of the ten years 1903 to 1912 are as follows:—"

DEPARTURES FROM THE NORMAL IN SEA TEMPERATURE, AND IN AIR TEMPERATURE OVER OUR ISLANDS.

1903.

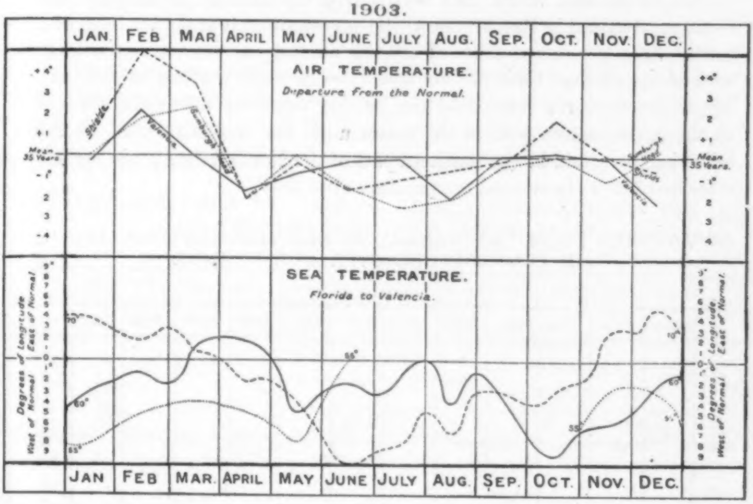

FIG. 10.

1904.

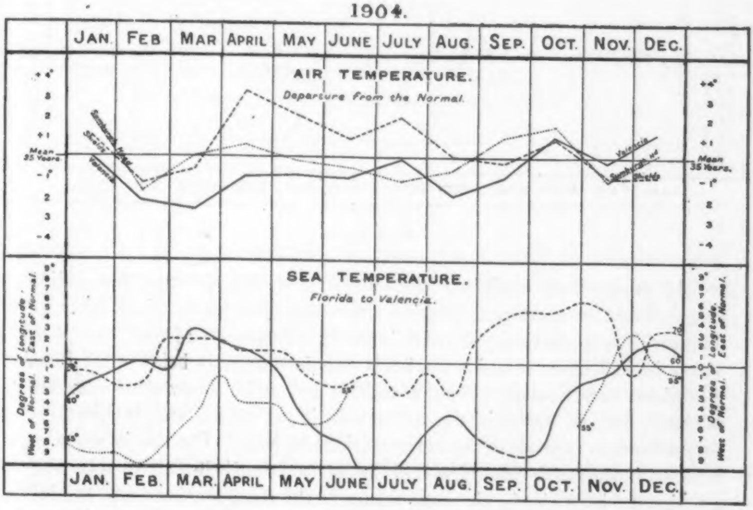

FIG. 11.

1905 (Fig. 12).

Sea temperature which had been above the average in January and February declined in March. In April the eastern limit of the 55° isotherm, representing the temperature of the sea nearest our shores, retreated 6° west of its average limit and remained below until the end of the year. The warm water represented by the 70° isotherm was not communicated to the north-eastern part of the ocean until the commencement of the following year, and in the northern part of the North Atlantic the surface remained below the normal temperature after July.

DEPARTURES FROM THE NORMAL IN SEA TEMPERATURE, AND IN AIR TEMPERATURE OVER OUR ISLANDS.

1905.

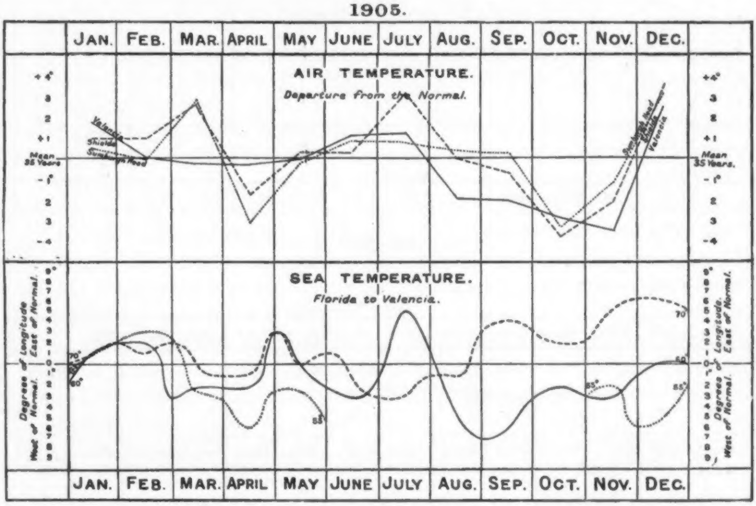

FIG. 12.

Air temperature exhibited departures from the average resembling those of sea temperature, making due allowance for a slight lag. In January it was above the normal, it fell in February, and rose, except at Valencia, in March, at which station it remained slightly below until June. At Shields and Sumburgh Head a decided decline in temperature occurred in April, but at Valencia the defect continued slight, and temperature commenced to recover at the three stations in May. The rise in sea temperature in the north-eastern part of the North Atlantic in July then became associated with a rise in air temperature at the three stations, and the fall in sea temperature in that region in the next month with a fall of air temperature at each of them. This decline in temperature continued until

October at Shields and Sumburgh Head, and until November at Valencia; after which the temperature recovered, rising above the average in December at the three stations.

1906 (Fig. 13).

Sea temperature as a whole kept near the average until May, but rose for the first three months of the year; the 55° isotherm, however, representing the temperature of the water near our western coasts, although advancing eastward, was to the west of its average limit during the three

DEPARTURES FROM THE NORMAL IN SEA TEMPERATURE, AND IN AIR TEMPERATURE OVER OUR ISLANDS.

1906.

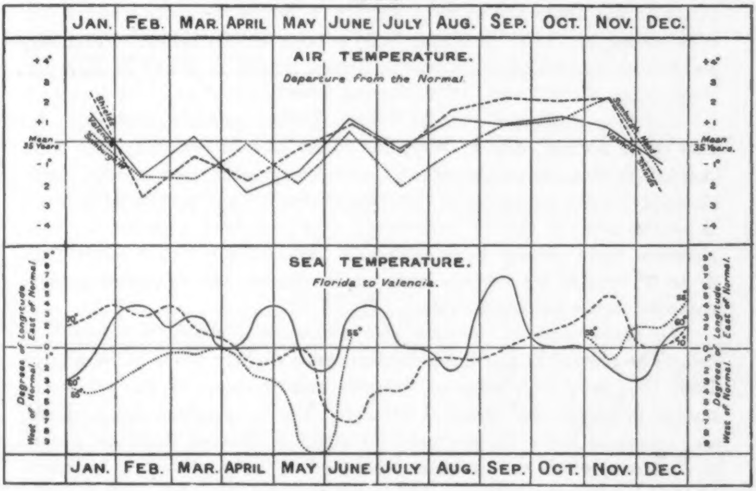

FIG. 13.

months. In April to August, inclusive, the surface temperature was mainly below the average, notwithstanding the fact that the 60° isotherm advanced 4° of longitude to the east of its average limit in April and June; for except in May the 70° isotherm was to the west of its mean limit during these five months; and the 55° isotherm, steadily retreating until June, reached a position 10° west of its mean limit at the end of May, after which, although indicating a defect in temperature, it quickly advanced eastward until September, when it had returned to its average limit. During the four remaining months of this year the temperature of the surface kept chiefly above the average, and in September the 60° isotherm advanced to a position 7° east of its average limit. In this month the sea round our south-eastern, southern, and western coasts was flooded with water having a temperature of 60° or above; and a species of pelagic mollusc, which abounds in the South-Western Atlantic, was found in the English Channel. At the end of November the 60° isotherm had receded to a position 3° west of its average limit, but the 55° and 70° isotherms were both to the east of their respective average limits.

Air temperature, stated broadly, was above the normal in January, and after that month below until June, when it rose slightly above. It again fell below the normal, but recovered in August, and remained above until December, when it declined decidedly.

1907 (Fig. 14).

Sea temperature in the middle and north-eastern part of the North Atlantic was above the average until May, but in the south-western part it is shown by the 70° isotherm to have been slightly below. From May to August sea temperature was in defect, largely in defect in June and July, when the 60° and 70° isotherms were from 6° to 7° of longitude west of their respective average limits; the 55° isotherm, slightly to the east of its normal limit in July, was to the west of it in August. After August it was above the normal over the greater part of the North Atlantic for the remainder of the year, except in that portion of it which is represented by the 55° isotherm, which showed a defect in temperature there during September and October, and had receded from 4° to 5° west of its average limit in November, but advanced rapidly eastward in the following month.

Air temperature in January and February is shown to have been below the normal at the three stations, very slightly below at Sumburgh Head, but nearly 3° below at Valencia and Shields. It was above the normal in March; 2·5° above at Valencia. The temperature then declined, and remained below the normal from April to October inclusive, except at Valencia, where the extension eastward of the relatively warm water represented by the 60° and 70° isotherms was first felt. During the remaining three months air temperature stood above the normal at Sumburgh Head, and mainly above at Shields, but at Valencia it was below.

1908 (Fig. 15).

Sea temperature in the south-western portion of the ocean as indicated by the position of the 70° isotherm, was slightly above the normal in January, owing, doubtless, to a brief increase in the activity of the Gulf Stream; but in the north-eastern portion it was slightly below. In February these conditions became reversed, but, while in March and April the excess of temperature noticeable in the south-western arm of the ocean in the first month had been transferred to the middle of the zone which is represented by the 60° isotherm, and which extended 8½° east of

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1907.

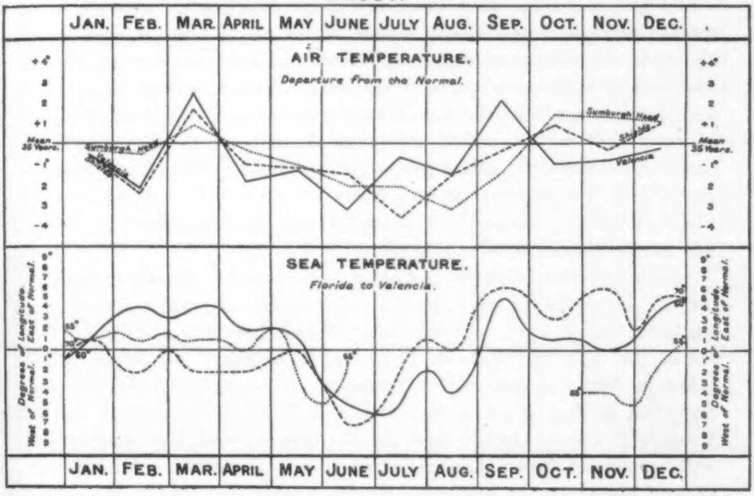

FIG. 14.

1908.

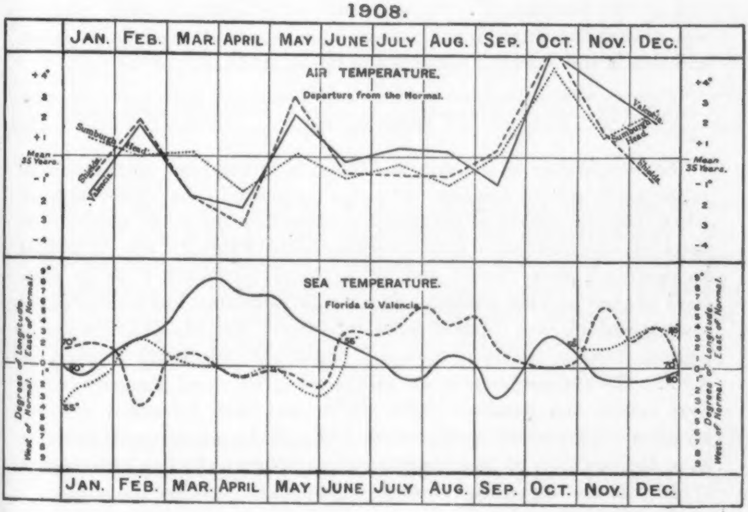

FIG. 15.

its average limit at the close of the former month and at the commencement of the latter, in the north-eastern and south-western parts of the ocean the surface remained at about its normal temperature.

In May a general fall in sea temperature took place. This fall continued during the two following months in the neighbourhood, and immediately to the south-west of our southern shores, but a recovery was shown elsewhere in June, the advance of the 70° isotherm 6° east of its average limit for the month at the end of July pointing to a considerable influx of warm Gulf Stream water. Although fluctuations are shown to have occurred subsequently, and a general, but temporary, fall of temperature was noticed in September, yet, as a whole, the surface of the ocean between Florida strait and the south of Ireland during the remainder of the year was warmer than is usual at that season.

Air temperature below the normal at Valencia and at Shields in January rose 1½° above the normal in the following month, afterwards falling until the latter half of April. At Sumburgh Head, where it was slightly above the normal in January, about the normal in February and March, it fell below in April. A general but temporary increase of temperature was registered in May, when at Shields it rose 3° above the normal, and at Valencia 2° above. In the three months that followed, the temperature, while somewhat lower than the average at the northern stations, was slightly higher at the southern. In September the conditions became reversed, and next month a sudden and decided rise of temperature occurred at the three stations, the excess at the northern and eastern being about 5°, and at the southern 4°. Subsequently temperature declined rapidly; and, while at Sumburgh Head it recovered somewhat at the end of November, at Valencia and Shields it continued to fall until the close of the year.

1909 (Fig. 16).

Sea temperature in January was found to be the same as the normal in the south-western Atlantic, but somewhat above to the north-eastward. After about the middle of the month a general decline in sea temperature occurred, which continued until the second half of February, when a decided increase took place, the 60° and 70° isotherms advancing 4° to the eastward of their average positions, and the 55° isotherm 1° to the eastward; sea temperature then declined considerably until May, except in the south-western Atlantic, where it showed a slight but temporary recovery in April. The surface temperature of the ocean increased generally in the next month, and remained above the normal until November, the 70° isotherm as charted advancing so much that in August it was as much as 8° to the eastward of its average position. During the last two months of the year the surface temperature was found to be below the normal.

Air temperature responded to the fall in sea temperature, which took place in January and February, but did not recover until April. In

March it fell at Shields as much as 4° Fahr. below the normal, and at Valencia and Sumburgh Head nearly 3° below.

Subsequently, responding for the most part to the modifications in sea temperature, but exhibiting a marked lag, air temperature rose and was slightly above the normal at the two last-mentioned stations in April and May, albeit declining at the east coast station after April; it fell decidedly

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1909.

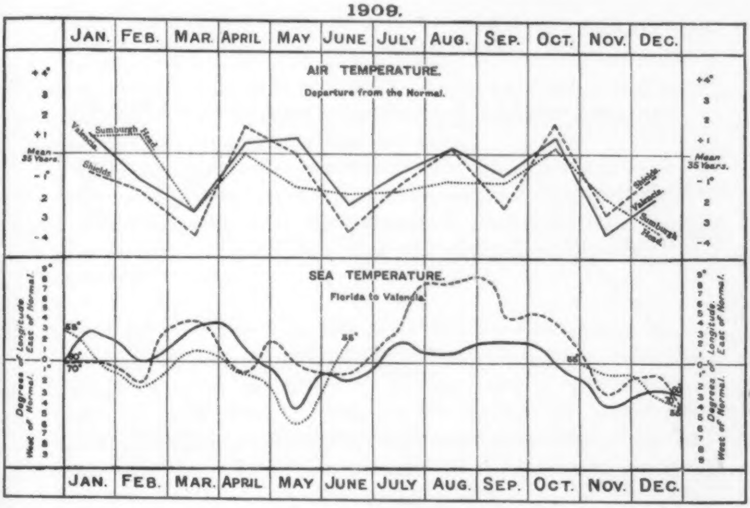

FIG. 16.

below in June; recovered in August at Valencia and Sumburgh, but remained below at Shields; fell temporarily in the following month at the two former stations, while gradually recovering at Sumburgh Head; rose above the normal at all three stations in October; after which it declined, and continued below for the remainder of the year, although it increased somewhat at the English and Irish stations in December.

1910 (Fig. 17).

Sea temperature, in the south-western and north-eastern portions of the North Atlantic especially, was below the normal in January.

A rise in sea temperature was recorded during February, when the 60° isotherm advanced 2° east of its average limit for the period, the 55° and 70° isotherms remaining at this time considerably west of these respective limits. The latter, however, advanced to its average position in

March and 2° to the east of this position in April, while the former again retreated in the third month, but advanced in the fourth, reaching its average position at the close of the month.

The temperature in the south-western arm of the ocean decreased in May, the 70° isotherm retreating nearly 10° west of its average limit at the end of the month. At the same time the abnormally warm water that had occupied this area in April, and had drifted north-eastward, now occasioned a rise of sea temperature nearer our shores, with the result that the 60° isotherm is shown 4° to the east of its average position.

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1910.

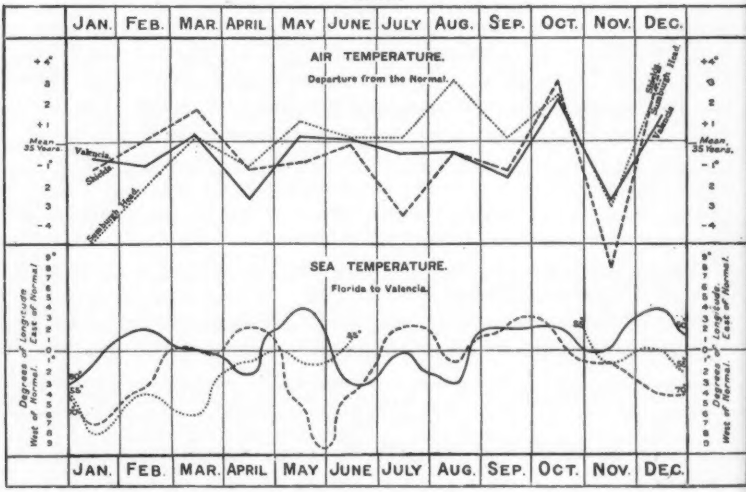

FIG. 17.

Subsequently the fluctuations in sea surface temperature, although well marked, were not large; the values registered, as a whole, being below the normal in June; above the normal in July; below in August; above during the two following months; about the same as the normal in November; and above in the closing month of the year, except in the south-western arm of the ocean, where it was below the normal.

Air temperature in January was as much as 5° below the normal at Sumburgh Head, but only slightly below at Valencia and Shields. While at the northern and eastern stations it rose steadily during the two following months, it declined slightly at the western station until March, in which month it was 1½° above the normal at Shields, but only slightly above at Valencia and Sumburgh Head.

The decline in air temperature at all three stations in April synchronized with the defect in the surface temperature of the northern half of the ocean during that month, and its rise in May with the spread eastward of the relatively warm water from the south-west, which is indicated by the advance of the 60° isotherm in that month, and was heralded by the advance eastward of the 70° isotherm in the previous month.

So far the influence of the ocean upon the temperature of the air over our islands is fairly apparent, but in the three months that follow it becomes less noticeable.

In June the air temperature at the three stations was not far from the normal, and the same may be said as regards Sumburgh Head in the month following; while at Valencia only a slight defect is indicated. At Shields, however, a decided fall occurred; and, although the temperature rose at that station in August, and no change took place in that month at Valencia, at both stations it remained somewhat in defect. It increased, however, decidedly at Sumburgh Head.

Associated partially with modifications in sea temperature, a decline in air temperature is indicated in September, a marked increase in October, as marked a reduction in the following month, when the defect amounted to as much as 6° at Shields, and 3° at each of the other stations; then a rapid rise in December.

1911 (Fig. 18).

Sea temperature in the northern half of the ocean is shown to have been slightly in excess of the normal in January, but, as indicated by the 70° isotherm, in defect but increasing in the southern half. Subsequently it increased to above the normal in the south-western arm of the North Atlantic until the end of February, and declined to the north-eastward during that month. The conditions were reversed in March, a fall in temperature taking place to the south-west and a rise to the north-eastward. Over the area represented by the 60° and 70° isotherms temperature rose in April, but declined to the north-eastward. After April sea temperature was in excess of the normal until October, except in the south-west portion of the ocean, when the 70° isotherm retreated to the west of its average limit in August. The temperature in this part, however, quickly recovered, the 70° isotherm which was nearly 9° of longitude to the east of its average limit at the end of May again advanced and was 7° east of it in October, and 9° in December, but retreated rapidly towards the close of the month. In the two closing months of the year the sea temperature was for the most part below the normal in the northern portion of the ocean, although south of the 44th parallel it temporarily rose more than 2° above.

Air temperature since the closing month of the previous year remained about the normal at Valencia and in excess of the normal at the two other stations—until February at Valencia and Shields, and until March at

Sumburgh Head. At the end of March the meteorological station in the Shetlands was transferred from Sumburgh Head to Lerwick. After March temperature declined slightly at this station and at Valencia; but increased to above the normal at the eastern station; and at the other stations after April, being largely in excess at all stations in May. It declined generally in June, but was nevertheless still above the normal in that month. Increasing again towards the end of June, temperature rose considerably higher than the normal in July and August, except at Lerwick, where it was moderately in excess in the former month; it fell

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1911.

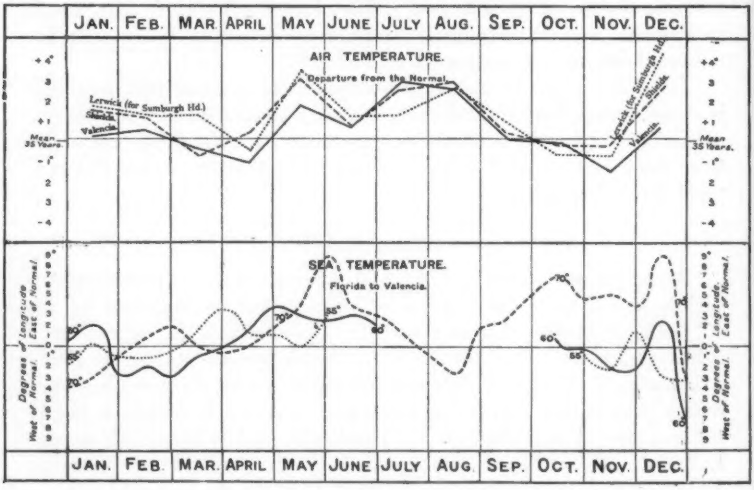

FIG. 18.

to about the normal in September. It was slightly below it in October and in November at the northern and eastern stations and more decidedly in defect at the western. Temperature rose above the normal in the last month of the year, when the excess was more than 4° at Lerwick and nearly 3° at Shields.

To sum up the conditions, as regards temperature, that prevailed during this abnormal year; in the months of January and February, from the close of April to the close of September, and again in December, the temperature of the air over Great Britain and Ireland was in excess of the average; moreover, during the months of May, July, August, and December it was greatly in excess. In October the temperature was about the same as the average, and in March, April, and November only can it be said to have been in defect.

1912 (Fig. 19).

Sea Temperature.—The temperature of the sea surface, which fell below the normal at the close of the previous year, continued in defect during the first three months of the year under notice, except in the south-western portion of the North Atlantic, where it rose above the normal

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1912.

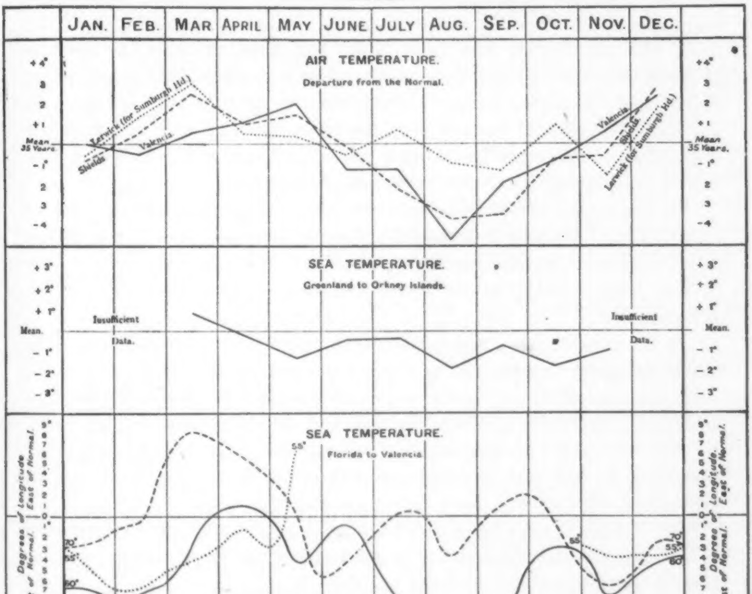


FIG. 19.

after the middle of February. The temperature then increased so quickly that in less than a month the 70° isotherm was charted 8° to the east of its average limit for March. In the more northern portions of the ocean, the surface temperature, although in defect until after March, rose from the middle of February until April, and in that month the charted results exhibited, for the most part, an excess of temperature over the North

Atlantic generally. The abnormally warm water, of equatorial origin, that was advancing north-eastward, and had been most noticeable in the South-Western Atlantic in March, and between the 40th and 50th parallels of latitude in the following month, reached the North-Eastern Atlantic in May, flooding the coastal waters off our southern shores, while a decided reduction of surface temperature was taking place in other parts of the ocean.

At the end of May, and in the beginning of June, the 70° isotherm had retreated 6° to the west of its average limit for those months, but a slight recovery of temperature was observed between the 40th and 50th parallels up to the middle of the latter month, when the surface temperature rapidly declined; the 60° isotherm in August having retreated as much as 13° of longitude to the west of its average limit. In the south-west arm of the ocean the temperature rose during June and July, reaching the average towards the close of the latter month, when it declined, but recovered in September. It again declined during the two months that followed, in the latter of which it became considerably in defect; and, although the sea surface temperature increased in the second half of November, it continued to be below the normal to the end of the year.

To the north-eastward the isotherm of 60°, and subsequently that of 55°, indicated a decided defect in surface temperature to the end of the year; albeit fluctuations are shown which harmonize with the temperature of the surface water to the south-westward, as indicated by the 70° isotherm.

In the zone between South Greenland and the Orkneys sufficient data are wanting for comparison with normal results until March, when the surface temperature is shown to have been slightly above the normal. It declined in April and May, rose in June, but continued slightly below in that and the following month, fell decidedly in August, recovered somewhat in the month following, fell again in October and rose in November.

Air Temperature.—Throughout the greater part of this year the curves of air temperature resemble, in a marked degree, those relating to sea-surface temperature.

In January the temperature of the air was about 0·5° below the normal at Lerwick and Shields, and the same as the normal at Valencia. It increased at the northern station in the two following months; declined slightly at the south-western station in February, then rose slowly until May; while at the northern station it fell in April, but continued to be above the normal in that and the following month. At Shields and Valencia there occurred a fall in temperature from May to August; except at the latter station where the results showed a check in the fall during July. At Lerwick, a similar fall in air temperature was checked after June until August, a rise occurring in the intermediate month which may be accounted for by the spread north-eastward of a layer of relatively warm water, indicated by the sea isotherm of 55°, which reached our south-western coasts in the previous month, and arrested the fall in air temperature at Valencia.

In September, the temperature at Valencia, which had decreased in August to 4½° below the normal, increased rapidly, and continued to do so during the remainder of the year, in the last two months of which it was above the normal. The fall in temperature at Shields also was checked in August, and at the same time it was arrested somewhat at Lerwick; while at the east-coast station it did not change materially until the end of the following month, when it rose quickly, then remained steady for a month, and again rose rapidly in the closing month of the year. At the northern station the fall was maintained until September, after which the temperature fluctuated, being 2½° above the normal in October, 1½° below in November, and 1½° above in the last month of the year.

The air temperature over the British Isles during the summer and autumn of 1912, in contrast with that prevailing during the same seasons of the previous year, is found, therefore, to have been below the normal in June to November inclusive, except at the northern station in July and October and at the south-western station in November, at which places it rose slightly above in the respective months. It was above the normal in February to May inclusive, except at Valencia, where the excess did not obtain until March. It was equal to, or nearly equal to, the normal in January, and above in December; at Valencia above in November also.

The question is frequently asked: "Has the Gulf Stream changed its course?"

In so comprehensive a form this inquiry cannot always be met by a negative, but this much may be said—

There appears to be no justification for the assumption that important changes have taken place in the circulation of the North Atlantic during historic times. The velocity and volume of the Gulf Stream exhibit modifications that are non-periodic as well as seasonal; modifications that may occur during any month, in any year. When the Stream is abnormally active, its resistance to the Labrador Current is probably carried farther north than usual; with the result that its north-easterly branch pursues its course in higher latitudes than obtains normally; and its relatively warm saline waters penetrate to the north-eastward of their average limits. When, on the other hand, the Gulf Stream is weaker than is usual, according to the season, the converse happens; the north-easterly branch of the Stream commences its new course after its collision with the Arctic current, in lower parallels than those in which it commonly starts, and, possibly, the easterly branch is augmented at the expense of the former; so that the influence of the Stream may be restricted in two ways.

In connection with an investigation undertaken at the Meteorological Office, having for its object a comparison of the changes in the strength of the Trade Winds of the Atlantic * with average results, and of changes in the surface temperature of the North Atlantic with normal values, there was found to be some evidence to prove that departures from the average strength of the two Trade Winds during a series of months, and at times during even so short a period as one month, were roughly reflected in deviations from the normal through the agency of the Equatorial Current and Gulf Stream in the average distribution of surface temperature in the North Atlantic in the corresponding series of months or month, as the case may be, of the succeeding year, notwithstanding the existence of many other causes affecting the temperature of the surface water, which must tend towards masking the appearance of such connection.

Proof may, therefore, be claimed, resting on a chain of evidence, that many of the climatic changes to which our islands are subject owe their origin to modifications in the Trade Winds of the Atlantic ; communicated through the agency of the great Equatorial Current, and its giant offspring the Gulf Stream.

Sir Duncan Johnston (before the paper) : Commander Hepworth has been kind enough to come here to read a paper on the Gulf Stream, and without more ado I will ask him to commence it.

Dr. W. N. Shaw (after the paper) : I would sooner speak on almost any subject in this room than on the Gulf Stream, about which I know little more than I did as a schoolboy. For anything that my office has to do about the Gulf Stream I go to Captain Hepworth, knowing that he is constantly keeping a watch on the behaviour of ocean currents from various points of view, and that he is in particular interested in the behaviour of the Gulf Stream. I have, therefore, listened with great interest to what he has been saying about this subject of perennial interest, but I may frankly say that I feel there are still a good many questions one would like to ask about the Gulf Stream. One, by the way—there was a case in which the tidal variation in a certain current was said to be as much as 3 miles an hour. Is that really so ?

Commander Hepworth : I was speaking by the book ; I am only quoting.

Dr. Shaw : That means, of course, that the variation becomes 72 miles a day ; but it seems such a considerable amount that I wondered if some mistake had not been made in the unit. The question of the Gulf Stream is to me part of a problem of the greatest interest because of its analogy with the problem of the circulation of the atmosphere, and that is the circulation of the waters of the ocean. I know so little about ocean currents, and I find it so difficult to picture them in my mind in a way that is satisfactory to carry about with one and keep by one as a guide and friend in all questions of the kind. From what Commander Hepworth said, I gathered his view was that the Gulf Stream was

* 'The Trade Winds of the Atlantic Ocean, Comprising : A comparison of the changes in the temperature of the Water of the North Atlantic and in the strength of the Trade Winds.' By M. W. Campbell Hepworth. 'Climatological Tables for St. Helena, with Report on the Records of the Robinson Anemograph. From 1892 to 1907.' By John Somers Dines, B.A. 'Note on the connexion between the periodic variations of wind velocity and of atmospheric pressure.' By Ernest Gold, M.A. Schuster Reader of Meteorology. Published by the authority of the Meteorological Committee. 1910.

part of a great circulation coming out of the Gulf of Mexico round by our shores, and so back again—a complete circulation of water which gets warm in one part of its journey and cold in another; like the circulating pipe of a hot-water circulation such as we have in our houses, there is always the same water going round and round. Well, that won't do for the atmosphere. We get into a terrible entanglement if we regard the atmosphere as circulating like that, and one wonders if oceanic circulation is of that kind. I can quite see from Commander Hepworth's diagrams that it is possible to represent a circulation going round: there is certainly what is technically known in mathematics as circulation, but then I am disturbed by that remarkable Labrador Current that comes down from the north and makes a plunge at the Gulf Stream and does something with it. I am not quite sure what it does. An interesting part of the question is how the water gets into the Labrador Current and manages to go on always coming from the north. With atmospheric circulation we are also accustomed to currents coming from the north. We cannot get an atmospheric circulation without them; we do not call it a Labrador Current, but it is a northerly or north-easterly one, and it comes into all our circulations. I wonder how it is accounted for in the oceanic circulation, and what is its relation to that current supposed to flow from the Mediterranean that somehow finds its way to our islands and further north.

These matters are rather difficult to illustrate, but one of the most appealing ways of representing the Gulf Stream is the diagram of isotherms that Commander Hepworth showed. You can see a group of isotherms close together, and you recognize the Gulf Stream. You see the isotherms spread out fan-shaped, and there is the continuation of the Gulf Stream. That congestion of temperature lines is not the Gulf Stream itself, but where the Gulf Stream is stopping. The place of great transition between hot and cold water is one boundary of the Gulf Stream, and the curious thing is that the Gulf Stream as indicated by isotherms has only one boundary. There is only one steep slope between hot and cold water. If the Gulf Stream was a hot current flowing along, there ought to be a slope of temperature on either side. Since the diagram has a steep slope on one side, the actual current must be somewhere to the south-east of what you see marked.

These ocean currents are profoundly interesting and mostly inadequately investigated in these days. After much labour we have got a picture of the surface circulation of the ocean, but now one wants to know what the departures from the normal are—a matter very difficult to find out. Commander Hepworth has done great service in studying the years represented in the diagrams. I am not sure he will carry us all with him in the demonstration of the direct connection between difference of temperature of the Atlantic in a particular year and the temperature of these islands in the same year. As a matter of fact, he has hit upon a very hard nut to crack—the temperature of these islands. We have the great Atlantic on the west, it is true, but we have the great Eurasian continent on the east, which disturbs almost any theory put forward as to the causes of temperature in these islands. If you want to get these islands frosted, for example, you can do it in two ways. You can get a current round by Spitsbergen probably coming right round from the north of Asia, or you can bring to bear upon us the influence of the great Eurasian continent on the east and bring the cold weather across by the Strait of Dover. In that way we are exposed to variations of temperature, warmth as well as cold, that make it particularly difficult to trace the relations. Still, the fact that we have got the diagrams on the lithographic stones means that we are making a certain definite advance, and I am very much obliged to Commander Hepworth for putting it before us.

Sir Henry Trotter: I have been quite unexpectedly called upon to take the chair, and as I have not studied the subject dealt with since long sea journeys to India in 1862, I am not prepared to speak on it. It only remains for me to propose a vote of thanks to the lecturer, Commander Hepworth, for the most interesting and detailed lecture he has given us—the result, I am sure, of much study and research. It will, I am quite sure, have been thoroughly appreciated by the scientific audience assembled here to-day.

Captain T. H. Tizard, F.R.S., sends the following communication: Few people, I imagine, who have had no practical experience of the Gulf Stream realize what it is and does. I was navigating officer in H.M.S. *Challenger* during her voyage round the world, 1872–76, and on two occasions the vessel passed through and sounded and investigated the depth, width, and velocity of this stream (see pp. 154–157 and 158–160 and plan at p. 134 of vol. 1, part 1, 'Reports of Scientific Results of the Exploring Voyage of H.M.S. *Challenger*').

On May 1, 1873, when in lat. 36° 27½′ N., long. 71° 46′ W., about 200 miles north-east from Cape Hatteras, we found the stream to be 15 miles wide, 100 fathoms in depth, and running at a rate of 3 knots, so that the *Challenger* had to be put before the wind and to steam at a rate of 3 knots to keep the sounding line perpendicular, which is as if the ship was anchored by the weights on the lead line with a current running past her at a rate of 3 knots. It was an astonishing sight and will not easily be forgotten by any one witnessing it. After crossing the stream here the vessel proceeded to Halifax, and from thence steered to the southward for Bermuda. In this section the Gulf Stream was broken up into a number of minor streams, five in all, extending over a breadth of 250 miles with cold water separating the streams from each other. The temperatures obtained below the surface proved that in no case did the depth of the warm water exceed 50 fathoms, and the rate of the stream, as shown by the current drags as well as by observation whilst the vessel was sounding, did not reach 1½ knots, so that about 400 miles to the north-eastward of the position on May 1 the Gulf Stream was being dispersed, its depth and rate only half what they were when the ship was in lat. 36° 25½′ N., long. 71° 46′ W.

With reference to the particular route followed by the Gulf Stream after passing Cape Hatteras, it is well to consider that the American rivers discharge into the Atlantic, north of that cape, a large quantity of cold water, very little of anything above freezing point during the spring, and this water, being fresh, although cold, keeps on the surface of the salter ocean and assists in keeping the Arctic or Labrador current cold. Moreover, the Gulf Stream, coming from the south where the Earth is moving from west to east more rapidly than it is further north, tends to make the Gulf Stream move in a north-easterly direction, whilst the Arctic water from the north, where the Earth moves at a less rate per hour than it does further south, keeps the cold water borne by it close to the coast. Such effects are well known, for even with trains travelling in a north and south direction one rail is always more worn away than the other, if the train is travelling north it is the eastern rail which is most affected, and if travelling south the western rail.

With respect to the influence of the wind in generating currents, one effect not touched on by Commander Campbell Hepworth is that a steady wind, like the north-east trade, blowing off the north-western coast of Africa, blows the surface water away from the shore, and its place is supplied by the cooler water from below, so that the north-west coast of Africa, from the Straits of Gibraltar to the Cape Verda islands, is blessed with sea-water of a comparatively low temperature, which has a beneficial effect on the climate. So much is this the case that even in the Straits of Gibraltar itself, the temperature of the sea in August at Tangier is 10° F. below the temperature of the sea at Gibraltar; this makes Tangier a more bracing place than the south of Spain.

Similar effects are produced by the south-east trade of the Pacific, for the water being blown off shore is replaced by the cooler water from below the whole distance from Valparaiso to the Galapagos island: the effect is well shown at Callao, where the sea-water has a temperature about 12° to 14° below the summer temperature of the air.

With regard to the influence of the Gulf Stream on the European coasts, it is generally inferred that because Great Britain, Ireland, the Færoe island, and Norway enjoy a milder climate in winter then Sweden, Denmark, Germany, etc., this must be due to the direct influence of the Gulf Stream. In dealing with this question it is necessary to consider the properties of salt water. That water, when heated, is not necessarily lighter than the cooler water below, for its specific gravity may be greater although its temperature may be higher. Thus the Mediterranean, the specific gravity of which is 1·028, against 1·026 of the Atlantic, has a uniform temperature of from 55° to 56° F. from a depth of 100 fathoms to the bottom, whereas in the Atlantic the temperature of 55° does not extend below the depth of 300 fathoms; this causes the Mediterranean water to flow out at the bottom near the submarine ridge which separates the deep basin of the Mediterranean from that of the Atlantic, and to flow in at the surface. This Mediterranean water sinks as it flows outwards, and causes the eastern basin of the Atlantic, between the European coast and the submarine elevation in the centre of the Atlantic, known as the Dolphin ridge, and between the Canary islands and the Wyville Thomson ridge, between the Færoe islands and the Shetlands, to be of a much higher temperature than the water in any other basin; as here the temperature of 40° F. is to be found at a depth of 1000 fathoms. This warmer water flows over the Wyville Thomson ridge above the cold water of the Arctic basin towards the coast of Norway, but doubtless receives some accession from the water impelled by the prevailing westerly winds of the North Atlantic between the northern edge of the Trade wind and the parallel of 50° E. Although the effect of the Mediterranean water cannot be separated from the drift current impelled by the westerly winds across the Atlantic, some portion of which has been heated by the Gulf Stream, still its effect must be very considerable, and it is certainly this water which flows over the Wyville Thomson ridge towards the Norwegian coasts and into the Arctic basin, the surface water from which appears to be diverted to the southward between Iceland and Greenland by the northerly winds prevailing in this locality. This is the main cause of what is known as the Labrador Current, though it is augmented by the offset out of Baffin Bay.

The following remarks have been communicated by Mr. Leighton Jordan:—

1. Among many interesting points in Commander Hepworth's paper the one which seems to me to be of the greatest importance in the present position of the discussion of oceanic circulation is his allusion to the records of tidal action in causing alterations of velocity in the Gulf Stream. The subject is not new, but is now, I believe, for the first time formally brought before the Royal Geographical Society, and Commander Hepworth, by his allusion to it, has opened a door which leads a long way. There can, I think, be no doubt

that the tidal action observed in the Gulf Stream and in the current of the Caribbean sea exists all along the anti-cyclonic current, of which they form a part, revolving between the equator and 40° N. At any rate, that anti-cyclone is the normal course for tide waves raised and controlled by the direct action of the moon, and a mathematical demonstration was about forty years ago given to show that there must, of necessity, be an incessant circulation of water through all such "forced" tide waves.* When such a wave is thrown against a shore-line the moon loses control and it becomes a "free wave," which has its course determined by the action of the Earth's rotation. That gives the wave a cyclonic course directly the moon lets go.

Such an offset from the Atlantic anti-cyclone enters the English Channel and shows its tendency to cyclonic motion by the greater force of its right hand side, which ascends along the coast of France, reaches the end of the Channel, and returns down the Channel by the English coast and passes Beachy Head before meeting the left-hand portion of the ascending tide. A precisely similar cyclonic tendency has been shown to exist in the river Plate; but, being in the southern hemisphere, it is the left-hand side of the ascending tide which predominates.†

2. The free Atlantic wave which enters the Channel has its action complicated by the direct local action of the moon tending to create a forced wave there with anti-cyclonic motion. And in fact the opposing tides meet near the Channel Islands, raising very high tides off the coast of France in their neighbourhood, whilst higher up the Channel they either neutralize each other, or create each an independent smaller tide so as to cause four tides a day.

The Atlantic cyclone is clearly the predominant tide in the Channel; but that does not appear to be the case in the Mediterranean sea. In the latter, the area for local tidal action is greater, and the access from the Atlantic is narrow. The Atlantic tide flows over a shallow ridge outside the Straits of Gibraltar, and immediately shows its cyclonic tendency by the greater strength of its right-hand side, which flows eastwards off the north coast of Africa until it meets the opposing anti-cyclone in the Bay of Tunis, where they combine to create a tide three times higher than in any other part of the sea; whilst further east they more or less neutralize each other.

3. In the central part of each of the great oceans there is a massive movement of the water from the equator towards the 40th parallel of latitude, compared with which the surrounding anti-cyclones are rivulets, though having in many parts greater velocities. Immediately the *Challenger* records gave practical confirmation as to the existence of that central motion in each ocean the solution of its cause became really the great paramount question in the theory of oceanic circulation; and that was recognized to be so by the late Mr. A. G. Findlay, who had long been the leading spokesman of the Council of the Royal Geographical Society on the subject.

The fact is, that whilst the moon raises the water in the open ocean about 4 feet above the level which the sole action of the Earth's gravitation tends to give it, the Earth's axial rotation raises it permanently about 13 miles above that level all round the equator. That shows the existence of a force acting on the ocean vastly exceeding the tidal action of the moon and the sun. It shows the lifting force of the Earth's axial rotation to be about seventeen thousand times greater than that of the moon. And by

* See p. 291 of 'Natural Philosophy,' by the writer.

† See 'The Sling,' by the writer, p. 273, 2nd ed.

a mathematical argument similar to that above referred to as necessitating an incessant circulation through any forced lunar or solar tide, it has been shown that the contrifugal force which raises that permanent tide can maintain the level along the equator only by creating an incessant circulation through which the water is lifted vertically along the equator and flows away laterally over each side to sink again in the temperate zones, and return in the understrata to rise again along the equator.*

PHYSIOGRAPHY AND GLACIAL GEOLOGY OF EAST ANTARCTICA.†

By GRIFFITH TAYLOR, B.Sc., B.E. (Syd.), B.A. (Cantab.), F.G.S., Senior Geologist to Captain Scott's Expedition, and Leader of the Western Parties.

PART VI.

Cwms.

It is only of late that the great importance of the cwm topography has been realized in England. This is surprising in view of the magnificent clusters of cwms ("Karling") which constitute Snowdonia and Cader Idris. The latter especially is a perfect example of a small Karling. In fact, one might safely say that the most striking feature in glacial topography in Great Britain has attracted the least attention.

On a recent visit to Barmouth the resemblance in the topography to that of Granite harbour (East Antarctica) was almost ludicrous. The same broad valley—the same riegel and high level terraces or alp plateaux; the rounded nunakoller and cuspate nunatakker; and on the slopes of the bounding walls the same magnificent cwms.

In Europe the cwms of Wales, the corries of Scotland, cirques of France and Kare of Germany and the Alps, are all confined to high-level topography. In Antarctica they are found at all levels, from near the summit of Mount Lister (13,000) down to sea-level. For instance, we spent some days encamped in a beautiful little cwm—now entered by the sea in Granite harbour. This was named the Devil's Punch Bowl, and was separated from the New glacier by the Devil's ridge, surmounted by the Devil's Thumb (see Plate I. (*b*)).

Another beautiful cwm was that occupied by the Davis glacier, just east of the Mount Lister. In both cases, as the maps show, the cwm was bounded by a comparatively narrow ridge, which was of great interest in the case of the Devil's Punch Bowl. For this ridge was all that separated the present new glacier from the deep bowl of the cwm, and yet it had

* See p. 293 of 'Natural Philosophy,' quoted above.

† Continued from p. 467.

suffered no erosion (see the Panorama Sketch of the Mackay glacier, Fig. 12).

This long, narrow curving ridge rises to 1000 feet at its proximal western end, and curves entirely round the south side of the cwm, gradually reaching sea-level at the snout of the New Glacier. About half-way along was the Devil's Thumb, 800 feet high. Just to the east of this knob the ridge descended steeply until it was practically at the same level as the surface of the new glacier here, and about 400 above sea-level. There was a slight drainage over the ridge—here about 10 yards across—and then a steep descent to the Devil's Punch Bowl below. The ridge was composed of red granite with harder red porphyry dykes. Some striae were visible

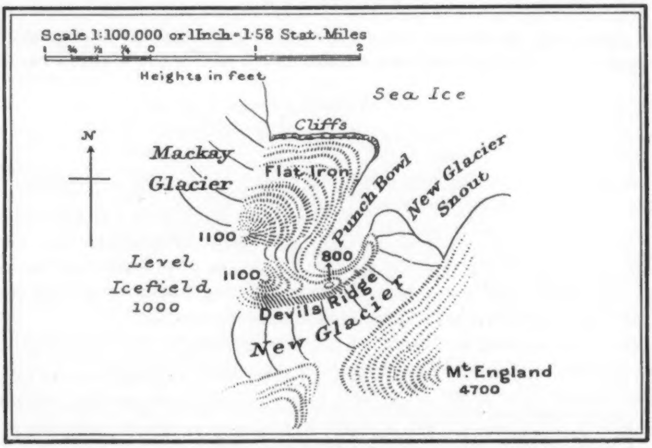


FIG. 15.—SKETCH-MAP OF THE DEVIL'S PUNCH BOWL IN THE SOUTH-WEST CORNER OF GRANITE HARBOUR.

on the latter, showing how recent had been the recession of the New glacier from its former steeper outlet. The glacier was nearly a mile wide, and was the sole drainage of all the ice-field to the west, so that one would have expected the ridge to have been planed away in a few years. My conclusion is that there is practically no important glacier planation by small glaciers.

The sea-ice occupies the greater part of the cwm floor. At the south-west end was a sheet of ice about 6 feet above sea-level, which I believe to be old sea-ice elevated by the thrust of newer sea-ice, but my colleague Debenham inclined to the belief that it was a relic of a glacier which now hung some 100 feet up the west cliff of the cwm.

A third interesting point is how the cwm floor came to be below sea-level. On the shores of White island far to the south, I noted a sea-level cwm, but otherwise they are not common. Obviously cwm erosion (by sapping) can hardly occur where the foot wall is covered by sea-water. Furthermore, no theory of glacier planation can account for a cwm valley 1000 feet deep, but only about 1 mile long!

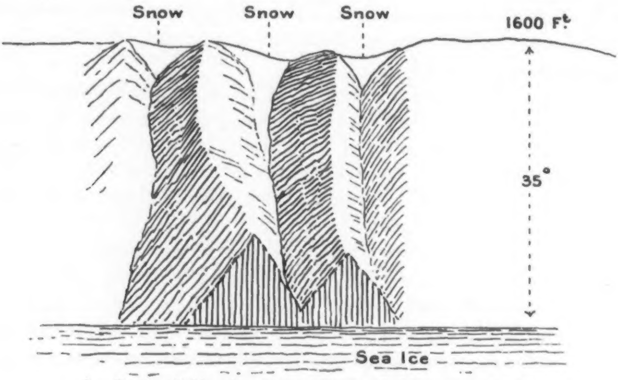
To my mind this drowned Punch Bowl points to a fairly recent subsidence of the coast here. In fact, the extremely steep slopes of the islets in MacMurdo sound and of many of the crags on the coast—and the great lack of beaches and strand-lines—all point to a later subsidence. The elevated beaches discovered by David and Priestley are marks of an earlier tectonic movement, in my opinion.

There is, of course, the question as to when this (now empty) cwm was cut. It is not of recent date, I believe, for it could not have arisen when the whole of the cliffs were covered by the Mackay glacier. And this certainly occurred during the last physiographic cycle. This old age seems remarkable in view of the wonderful preservation of the slopes, outline, and angles of the Punch Bowl.

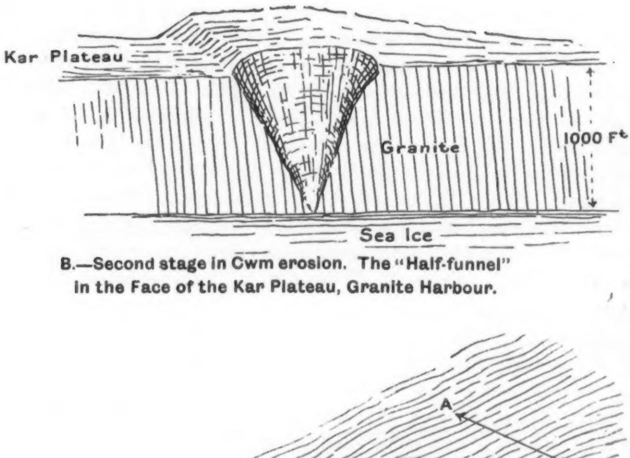
It seems reasonable to say that as in the glacial age in Europe the cwm structures were developed above the glacier-flood topography, so they would be in Antarctica. Hence cwms due to present glacial conditions in Antarctica should, on the whole, characterize a zone above 2000 feet. Thus sea-level cwms, and cwms below the ice-cap and (outlet) glacier-flood level, belong to the beginning of the advancing hemicycle.

Initiation of Cwms.—Some of the most interesting features in Granite harbour and New harbour were the examples of cwms in early stages. Here we have conditions favourable for their growth. A retreating glaciation has left great scarps and facets often rising from 1000 to 2000 feet from the sea. I have described the "glacierets" on the gentle slopes and plains of Cape Evans and other suitable spots. They may give rise to small cwms by "nivation," but it is on exposed slopes of greater angle where with ice, as with water, the erosion effect is more striking. Thus on the sides of Mount England, of Discovery Bluff and of the Kukri hills were exhibited the first stages of cwm growth. Here the snow-drifts lying on the slopes of the bluff had gradually cut out large gullies extending from top to bottom of the bluff. The snow forms a continuous supply of water for the freeze-and-thaw effect, which is so potent a factor in glacial erosion. These gullies were about 50 feet deep and filled with a coarse talus of granite blocks up to 4 feet in length. Some water assists in removing the talus, but the latter is removed largely by the combined effect of frost and gravity. There is a tendency to keep to the angle of repose of the talus in all these gullies, and this is about 33°.

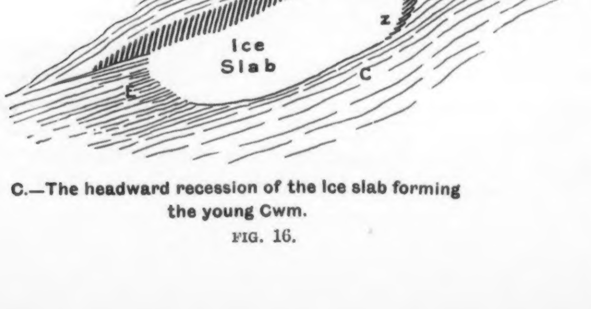
Across the harbour in the cliffs of the Kar plateau the next stage was illustrated. Here in a similar position was exhibited a contour which had assumed a rounded shape and closely resembled the half of a conical funnel. It was cut out of a 1000-foot cliff of granite capped by dolerite. Another gigantic example of the same shape was visible in the face of a mountain about 7 miles south-west of Mount Suess.



A.—Part of the Northern Face of Discovery Bluff showing Couloirs.



B.—Second stage in Cwm erosion. The "Half-funnel" in the Face of the Kar Plateau, Granite Harbour.



C.—The headward recession of the Ice slab forming the young Cwm.

FIG. 16.

Grading into the typical cwm was a series of hollows in the northern face of the Gonville and Caius range—of which Discovery bluff forms the eastern extremity. Thus Mount England showed many deep couloirs, while the Minnehaha ice-falls and Robson glacier descended from typical "armchair" cwms (see Plate I. (*c*)).

I think that the uniformity of the angle of slope—from 30°–35°—indicates that gravity has a lot to do with determining the shape, for this is near the "angle of repose" of talus.

The further stages of erosion, given a large snow-drift (which automatically becomes ice in the Antarctic), is as follows: In the annexed diagram (Fig. 16, C), the headward edge *xyz* is in a more favourable position for collecting the erosive agent (water for frost-splitting), as it receives all drainage enclosed between the lines *Ax* and *Bz*, whereas at *D* and *C* there is no such extraneous supply.

This causes the ice slab to eat into the hill at right angles to the slope. When the ice-slab is of sufficient size, the protective factor comes into play, and the flat bottom of the cwm is preserved. The Bergschrund, at *xyz*, is, of course (as Johnson has postulated), the means of entry for the water; the resulting angle of the cliff is, however, determined by gravity.

Part VII.

The Finger Valleys.

Along the Royal Society range, which is from 30 to 40 miles long, is a suite of valleys described in the narrative of the Koettlitz glacier (*ante*). They tend to radiate from the highest portion of the massif—which is Mount Lister, 13,000 feet high. Taking them in order from north to south, their dimensions, etc., are as follows (see Fig. 10):—

No.	Name.	Length in miles.	Width.	Height of floor.	Tributaries.	Length of ice.
1	Blue glacier valley	25	2–4	2500 to sea-level	one glacier	25
2	Hobbs " "	18	2–3	1500 to sea-level	none	18
3	Davis " "	10	2	500 to sea-level	three empty	5
4	Garwood " "	13	1–2	500 to sea-level	one glacier	6
5	First hanger	8?	2	800	none	none?
6	Miers glacier valley	17	1–2	1000	none	7
7	Second hanger	7	1	800	none	none
8	Ward glacier valley	8	1	800	none	4
9	Howchin " "	5	1	800 to 200	none	4
10	Walcott " "	8	8	1000 to 100	none	7
11	Dry valley to west	5?	1	100	none	none

These glaciers have been described as relics of a preceding ice-cap or piedmont left as ice-slabs on the lower slopes of Lister. But their

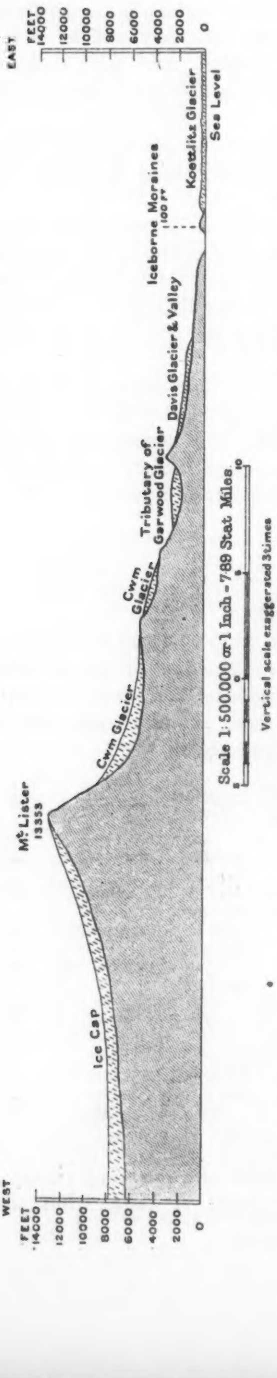


FIG. 17.—SECTION THROUGH MOUNT LISTER FROM THE PLATEAU TO THE KOETTLITZ GLACIER, SHOWING THE COLLINEAR SERIES OF CWM GLACIERS TERMINATING IN THE DAVIS "FINGER VALLEY."

topography is opposed to such an origin. Such a description fits the small supine glaciers (Cat's Paw, etc.) on the northern slopes of the Taylor glacier, but here another method of formation is indicated of cwm-cut valleys, cut from the coast backwards into the foothills. It will be noticed on the map (Fig. 10) that in the majority of cases the glacier is confined to the upper end of the valley. Is it possible that we have here the actual agent still at work in the form of a small cwm glacier burrowing its way westward by thaw-and-freeze action? I see no reason why such is not the case. If cwm action be allowed, then obviously the length of the boring tool—to use a mining simile—is unimportant; it is the cutting edge that counts!

On February 19, 1911, we ascended Davis valley almost to its head. Four or five miles from the coast-line the steep hillsides rise somewhat abruptly (from the morainic slopes bounding the Koettlitz) to a uniform height of 3000 feet. These were composed of solid limestone and marble. We soon saw that the upper part of the valley was occupied by a glacier, whose snout was 40 feet high.

A range of mountains 4000 feet high seemed to be behind the upper end of this U-shaped valley, and I was very anxious to see whether the glacier really came in round some angle. For if not, here was a glacier not more than 8 miles long which had cut out a valley 3000 feet deep and 1 mile or so broad! We crossed the mouth of a side valley opening 1000 feet above the glacier. This was quite free from ice, and was a perfect bowl-valley or cwm. On the opposite north side was another hanging valley with a most beautiful U-shaped section. It was abruptly truncated by the plane surface of the Marble cliffs, which were cut to the usual angle of 35°. After ascending many outcrops of limestone, schist, and granite, I reached the head of the glacier, and saw that it originated in a cwm about 4 miles from its snout. Its snowfield was, of course, very circumscribed, but reached the ridge in several places. The glacier up here was not crevassed, and the main surface lay only 200 feet below me.

The important point to notice is the sharp crest behind this cwm. Just behind it lay another glacier, which we believe drained into the adjacent Garwood valley. *There is no doubt that this deep, if short, trog-tal is entirely due to cwm recession.*

We ascended five other "finger" valleys, and found them to be of the same type, the cliffs all about 33°, and all thinly covered with *débris*. They are usually cut in reddish schistose granite, but the rock has apparently little effect on the topography. The floor is covered with moraine, and there is often a moraine 100 feet or more high at the mouth. The latter is, however, possibly a lateral left by the old Koettlitz glacier.

On March 1 we climbed Terminus mountain overlooking the Ward glacier valley. This was 3000 feet high, and gave us a good view of the Hinterland with its finger valleys, cwms, and glaciers. The upper slopes of Ward valley consisted of schists and granite rocks without any covering of talus. We could see that the foothills rose to about a height of 3000 feet. The valleys were separated by long ridges, so narrow in places that two adjacent glaciers were almost apposed just west of us. Triangular fragments of the surface were left by the cwm action, giving specimens of "biscuit-cutting," such as Hobbs describes in the Rockies. From all points of view the finger valleys led to cwms, and above these were other tiers of cwms, until the summit of the scarp was reached.

N.B.—In the map (Fig. 10) an attempt is made to show these upper cwms, but it was impossible to reach them in the time at our disposal. They were checked by cross angles from the last, but are only approximately plotted. They are universally filled with snow and ice.

VIII. *Glacial Erosion.*

In a preceding section I have given my opinion that there is evidence of an earlier type of erosion in the Dry valley. There is great probability of cwm action having affected the fault scarp to the north of Blue glacier, just as much as to the south. It is difficult to account for the barriers across the Taylor trog-tal in any other way. I can best show my idea of the evolution of this great trough valley, formed of three almost independent basins, by means of sketches, which are merely diagrammatic.

I suppose a continuation of the Royal Society range to the north, which was acted on by the cwms, just as at present on the slope below the summit (13,000 feet). This cwm erosion cuts out two big steps, and by headward erosion these valleys recede some 8 or 10 miles into the slope. Meanwhile, the Polar ice-cap is creeping down from above, and ultimately overwhelms the two cwms, cutting out rounded valleys over the cwm heads, but leaving much of the latter as bars in its path. Hence arise icefalls and great crevasses.

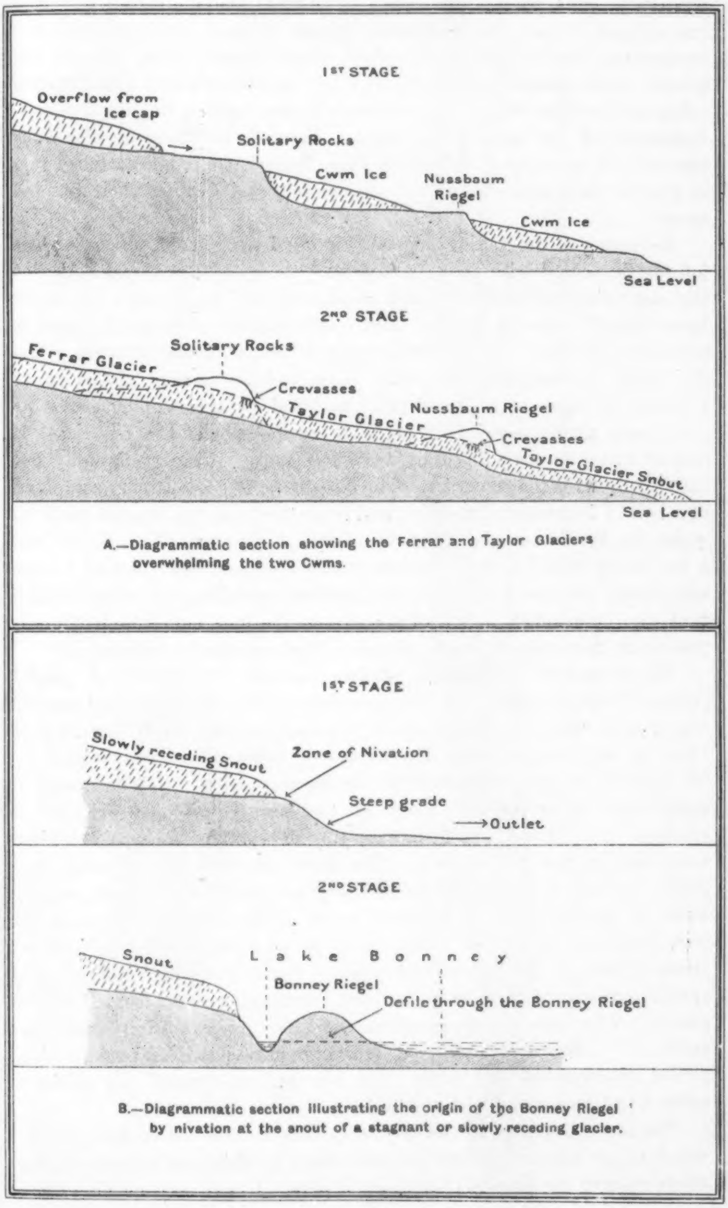
It still remains to account for the smaller riegel and lakes, and for the defiles in the Dry valley. They bring up another question—that of the form of erosion probable in a stagnant glaciation. It is difficult to believe that the defile shown in Fig. 9 has ever formed the outlet of the huge glacier to the west. I have come to the conclusion that this V gorge has been cut out by water action since the glacier occupied the valley to the sea.

At the little Bonney riegel some 5 miles up the valley is a similar defile also on the north side of the valley, though only 400 feet deep. I see no reason why, if a glacier snout occupies a constant position for many years, and if there is a suitable get-away for the water, there should not occur thaw-and-freeze action, which would easily cut out such a gorge and also lower the main valley appreciably. Then we should have the annexed diagram (Fig. 18, **A**) converted into the following (Fig. 18, **B**). Such is my explanation of the small riegel across Lake Bonney. As the glacier recedes, this thaw-and-freeze effect follows it up-stream, but if the retreat is rapid the thalweg is not levelled.

I here emphasize the fact that the Taylor glacier is apparently over-riding moraine at its snout, and that it is separated from the walls of the gorge by a moat often 100 feet deep. Both of these facts militate against true glacier planation. This moat is usually covered with an *apron* of ice, which does not show cracks, and so presumably the glacier has practically no velocity at its edges. The same conditions hold true for other glaciers. I measured the *moat* at the west end of the Kukri hills. It was nearly 200 feet deep. The ice of the stream (February 8, 1911) was 104 feet wide, and the dolerite cliffs were at an angle of 42°, though the general slope was less. The ice face of the glacier along the moat was at an angle of 36°.

If sapping be admitted to be a potent agent at the head of cwms, why should it not be equally potent along the sides of glaciers, which often last far longer than does the cwm ice? I do not imply that planation has not played the main part in producing the faceted walls of the European trog-taler. Here, presumably, the temperature has never been so low as in Antarctica, and so the glaciers were never so sluggish and inactive as in the south.

I think it time that attention was drawn to the comparative rarity of striated blocks in glacial *débris*—even in ground moraine. In the first



A.—Diagrammatic section showing the Ferrar and Taylor Glaciers overwhelming the two Cwms.

B.—Diagrammatic section illustrating the origin of the Bonney Riegel by nivation at the snout of a stagnant or slowly receding glacier.

FIG. 18.

western journey during four weeks' work amid glacier *débris* I only saw one striated block. On the Mackay glacier polished platforms were not uncommon, but the lateral moraines rarely showed striæ. Under the glaciers of Ross island we found only a few boulders showing broad thrust-marks rather than striæ. On the great Tasman glacier (in New Zealand) moraine-striæ are noticeably absent. Faceted boulders are also very unusual "down south," though on Cape Roberts we found flattened tors of granite which exhibited planation since they had acquired their rounded shape.

Reverting to the Taylor trog-tal (Fig. 8), I explain the topography as follows (in accord with the "palimpsest" theory). The round valley at the east rising to 2000 feet I believe to be a cwm floor, which has never been strongly affected by the later outlet glacier, although its floor is somewhat glaciated and granite erratics 6 feet high are common. The flat valley between the Nussbaum riegel and the present glacier snout I believe to have been considerably modified by the sapping action as the glacier slowly receded. The defile at the side of the big riegel is largely water-cut or sapped by thaw-and-freeze. The stratigraphy has little to do with the structure. The Nussbaum riegel is largely composed of a belt of limestone and schist, and is weaker than the granite rocks in which the basins are eroded. Solitary rock has a steep seaward face and a less steep inland face. I believe it also is a cwm head, but as I have not closely examined it, I can only give my surmise. It is my opinion that the "plucking" action of glaciers on the bars across their floors is practically non-existent in the Antarctic under present conditions.

The Scour-wall Hypothesis.—Before leaving the subject of glacial erosion, I wish to emphasize the possibility of the above method having contributed largely to the shape of the valley walls. It is certain that there is very little planation of the true type being carried on in lat. 78° S., for there is so little movement of the glacier, and so little discharge of *débris* from below the ice. There are two positive pieces of evidence of erosion. (1) The magnificent facets; (2) the rapid frost action exhibited *inter alia* by the *débris* cones. The latter are certainly of fairly late origin, so that if *they* break up and weather away, why should not the *walls* of the trog-taler? We thus arrive at the conclusion that in the over-deepening of glacial valleys may be an expression—not of glacier erosion, but of the increase of erosive factors sapping, etc.) along a special portion of their area, *i.e.* around the margins of the ice. It will be asked, "Why does not the centre of the valley (on exposure) appear less eroded?" Because, this type of erosion requires a long and very gradual period of recession, and given this, the bed *in front* of the glacier is eaten away *pari passu* with the sides.

The lower slopes of all the dry valleys are covered with a fine gravel—which to my mind represents the final stages to which the thaw-and-freeze effect reduces the material on which it acts. I have seen nothing like it

DETAILS OF THE SNOUT OF HOBBS GLACIER, FROM A SKETCH BY DR. E. A. WILSON.

THE UPPER KOETTLITZ GLACIER AND TRIBUTARY VALLEYS TO THE NORTH-WEST, FROM A SKETCH BY DR. E. A. WILSON.

FIG. 19.

in the fluvio glacial deposits of the Alps—and of course it would soon be sifted and altered in character if rain fell on it much.

I ought, perhaps, to be content to leave the 3000-foot facets of the south to be explained by a previous glaciation—more energetic and more resembling that of warmer regions. But there *is* considerable thaw-and-freeze occurring still in the south—there is little true planation, and little true aqueous erosion, and I am not sure that a stagnant glacier, filling a normal river-cut valley, would not ultimately give rise to faceted walls and to a typical catenary profile. It is easy to see that projecting spurs would be subjected to greater erosion of this gnawing type. When occasional streams flowed along the margins of the glacier they would exert greater force here, and ultimately the spurs would be truncated and the long sinuous trog-tal produced, without calling in the mass-effect of the ice at all.

IX. *Glacier Deposition.*

Moraines.—In our traverses of five large glaciers we met with no continuous moraine borne by the ice. On the Ferrar glacier, below the Cathedral rocks, were two medial moraines. The northern was hardly worth the name, but the southern was about one-third of a mile wide, and consisted chiefly of dolerite blocks about 20 feet apart. Similar scattered moraine occurred below solitary rocks. The ridges were better defined near Gondola ridge, on the Mackay glacier, but only for a mile or so, and then they also deteriorated into scattered blocks.

I remember no large rocks included in the Wilson piedmont, though one or two brownish patches on the ice cliffs indicated some silt and pebbles. Even on the lower Koettlitz, the weathering of the pinnacle ice was due chiefly to blown silt. However, to the north of Brown island in the same region there was a greater deposit of moraine than any I saw elsewhere. On the other hand, the beds of the dry valleys were buried under moraine—uniformly spread thereon and implying a long-continued and gradual recession; while the walls were in many places covered to a height of 1000 feet with ancient lateral moraine. In this preliminary account it is not possible to adequately discuss the relation of the lateral moraine deposits to the *débris* resulting from rocks weathering *in situ*.

At the mouth of the Hobbs and Davis glaciers (see Fig. 19) were striking silt-deltas over half a mile wide, mapped out in square "tesselations" due to solifluction. At the side were beautiful terraces about 5 feet higher. These were perfectly flat, and built of fine gravel with most remarkable clean-cut edges. The whole topography had a very recent appearance. As we marched up the Davis valley, the sides were marked by lateral ridges in several tiers. These were about 30 feet high, and in some cases contained much ice. At one spot the silt covering the sides was marked by vertical stripes of darker material, as if the whole had moved slightly and cracked along these lines. The ridges followed the contour of the hill, and were lake terraces on a larger-scale than those of Cape Evans. In this case the dam was probably the Koettlitz glacier at a period of greater volume. It was extraordinary how well-preserved were the edges of these terraces, for the Koettlitz had certainly not dammed up the Davis valley for centuries.

Undoubtedly the most striking feature of many of the moraines—especially at Cape Evans and at Mount Suess—were the *dêbris* cones (see Plate II. (*b*)). These were piles of *dêbris* quite conical in shape and sometimes rising to heights of 40 feet above the general surface. They were largely composed of fine gravel, and their regular shape and unknown

FIG. 20.—A SMALL DÊBRIS CONE OF "SHAP" GRANITE ON THE MORAINE 2 MILES NORTH-EAST OF MOUNT SUESS.

origin puzzled us at first. Ultimately, however, a whole suite of examples was observed, showing that they were derived from erratic monoliths weathering in place. At Gondola ridge was a piebald cone about 50 yards long and 25 feet high. It was composed half of dolerite and half sandstone, the two component blocks originally lying side by side, and breaking up at much the same rate.

In conclusion, I wish to thank the Society for accepting this lengthy paper in view of the very limited time at my disposal for its preparation; and also Mr. Frank Debenham (my Antarctic colleague) for editing the MS. after my departure for Australia, and for the use of several of his maps and photographs.

Mr. Douglas Freshfield, Vice-President (before the paper): Mr. Griffith Taylor, who is going to lecture to us upon the Glaciers of the Antarctic, needs no introduction—no member of Captain Scott's expedition does—and, as we all know, he was a very distinguished member of that expedition. He was at the head of the geological branch, and he was also the leader of the western parties. I will not make any further remarks now, but ask Mr. Taylor to read us his paper, or as much of it as he can in the time at our disposal.

Prof. David (after the paper): I am not prepared to discuss this very interesting lecture by Mr. Griffith Taylor in much detail, but what I have to say is partly and very largely the result of what my geological colleague, Mr. Priestley of the Shackleton expedition, and later geologist on the Scott expedition, and I have collected for our work now going through the press. In the first place, with reference to the map outline showing the probable shape of the Antarctic continent, it appeared to me that, on the whole, scarcely sufficient stress was placed on those low mountain ranges seen by Amundsen at the foot of the high meridional range which bounds Ross Sea on the western side and then trends first in a south-south-easterly, then in an easterly by southerly direction, about 200 miles north of the South Pole. Between King Edward VII. Land and the Queen Maud range, it seems to me that there is no room now for any wide ocean strait. That question of the division of the Antarctic continent into two parts, respectively a west and east Antarctica, is one which, of course, has very much exercised geographers in the past, and still exercises them, but it seems to me that the existence of anything like a wide strait has really been now disproved by Amundsen, so far as relates to the portion which lies nearest to the Ross sea area. Whether further in the direction of the Weddell sea there may exist a strait trenching through that gigantic range of mountains, which has been supposed by some to be a continuation of the Andes, is a question which we must all hope that the new expedition now being fitted out by Shackleton will once and for ever solve. Then as regards the next point. Mr. Taylor spoke about this great range of mountains which margins the Ross sea on the west as the main dividing range, I understand, of that part of the Antarctic continent. Undoubtedly this great range would probably be the main dividing range, if the whole of the great ice-cap and glaciers of the Antarctic were to melt away now, and the precipitation, which now falls as snow, were to descend as rain, and rivers and lakes were to take the place of the ice-cap and glaciers. But it seems to me we are met with a very curious physiographic fact in the Antarctic continent just now, in the position of the parting of the inland ice-flow. On the journey which I was privileged to take with Dr. Mawson and Dr. Mackay to the South Magnetic Pole area, we found that there was a very definite ridge—not a sharp ridge, but a gentle rounded top of the ice plateau considerably on the inland side of this coast range which formed at present, if I may so term it, the inland ice-parting. From that ridge the ice flows in two directions, partly down towards Adélie Land, Mawson's base, and partly down through great gaps in this coastal range, to which Taylor has referred, into the Ross sea area. In the case of the South Pole plateau, I think it has been shown that the South Pole itself is not the highest part of the moving ice-sheet, and it is by no means improbable that from the South Pole the ice-sheet moves in the direction of the Weddell sea, or, at all events, towards some point lying between where Frank Wild had his base under the Mawson expedition, near Termination glacier and Graham Land; while at the furthest point reached by Shackleton, which was just at the top of what may be termed the ice divide, on his expedition of 1908–1909, the ice moves from that divide apparently through these narrow valleys trenching this main range into Ross sea. Thus we meet with the curious feature, I think, in Antarctica, of a great mountain range which is far higher than any part of the inland ice, and which yet is not the main divide for the principal ice movement of that continent. The ice divide is something like, in the case of the Magnetic Pole region, about 100 to 150 miles inland from the western side of this great coast range. There are many extremely interesting points in connection with those rock-bars, such as the Bonney Riegel to which Mr. Taylor referred. I would like to ask him the question as to how exactly, in the case of the extraordinary Nussbaum Riegel, rising 3000 feet above the general level of the valley, does he explain the erosion of that very narrow " V " shaped valley which I think was on the north side of the Riegel. It seems to me strange that the greatest " V " shape erosion should take place on the north side of the Riegel, because the sun would shine chiefly on the south side of valleys flowing from west to east, and one would expect, therefore, that the greatest amount of thaw would take place on the south side of the valley, and that the thaw water action would be at its maximum on the southern side rather than on the northern side. The view he has expressed as to these great outlet glacier valleys, great by-washes, or spillways of the inland ice, having been formed by a series of old cwm glaciers is, to my mind, quite an original, very ingenious idea, and unless one can conceive that there were pre-existing rivers in middle Tertiary times, an epoch when we know there was an abundant vegetation in Graham Land, I do not see how these great outlet glaciers can very well be otherwise explained—on the assumption, that is, that the outlet glacier valleys are entirely the result of ice erosion, and not partly of tectonic origin. This immense range, through which the glaciers penetrate, rising, as Scott, Shackleton, and Amundsen showed, in places up to over 15,000 feet, represents a great fault range, and the faulting is probably of no very ancient geological date. How the great ice-sheet managed to force its way across this gigantic barrier is one of the greatest puzzles of the present moment, to my mind, in Antarctic physiography. I would like to ask some further questions. Does Mr. Taylor consider that river action in late Tertiary time has, in the first place, determined the position of these large outlet glacier valleys to any extent? Does he consider these great outlet valleys at all of tectonic origin due to faulting at right angles to the trend of that great chain which has been thought by some to be a continuation of the Andes? It seems to me quite possible that there never was, since the faulting which produced this Antarctic Horst, or so-called Andes, any river action which would cut out valleys by pure river erosion, but it is possible that the great ice-cap during the culmination of the glaciation was banked up so high on the western side of this inland range that it was able to overflow through the lowest gaps in the range, either sweeping bodily through wide tectonic sags in the horst or using as outlets the low cols formed by the erosion of cwm glaciers on either side of the horst as Mr. Taylor has suggested. In regard to the information he has given us—the result of the measurements made by himself and Mr. Debenham—as to the rate of movement of the Mackay glacier, it seems to me that it is a very important contribution indeed to modern glaciology, and is a great help towards understanding what Scott so clearly demonstrated, which is, that the whole of the Ross Barrier is in a constant state of movement at the rate of something over a quarter of a mile per year. In regard to the crevasses, Mr. Taylor suggested, I think, that the snow lids were somewhat V-shaped, like a symmetrical wedge hanging thin-edge downwards in the crevasse. That was our experience in the case of some glaciers, but in others we found that, where there was a constant westerly wind sweeping down a glacier running from west to east, the wind blowing down from the plateau to sea-level across crevasses trending from north to south, the snow lids of the crevasses were mostly of the shape of a wedge cut in half, that is to say, in the case of these north-and-south running crevasses the prevalent wind, coming from the west, drifted the snow against the east wall of the crevasse, so that the lid was always strong and thick on the eastern side. We tested some of the lids with our ice axes, and found them thick and solid. On the western side of the crevasses the snow lids thin out to a thickness of only a few inches, so when working up against the prevalent wind we always had to be on our guard against the western side of these snow lids: that is, the windward side was always thin and would let us down. I do not know if Mr. Taylor came across instances of lids of that type, as well as of the symmetrical wedge-shaped type. You may be glad to hear that in Australia we have received satisfactory wireless messages from Dr. Mawson quite recently. One reached me in mid-ocean on my voyage over between Australia and Ceylon, from Captain Davis of Mawson's ship, saying that all was well; that he had relieved the wireless and meteorological station established by Dr. Mawson at Macquarie Island, midway between the Antarctic and Australia, and hoped to bring back Mawson and his six comrades from Adélie Land safe and sound to Adelaide by the end of February this year. In conclusion, I hardly like to say much in Mr. Taylor's praise, because doing so is almost like praising one's own University of Sydney, but he is so cosmopolitan, having imbibed so much from Cambridge, America, Germany, and Switzerland, as well as, I hope, something from Australia, that I may be permitted just to say that it is literally true of him that there are few things that he has not touched, and nothing that he has touched that he has not adorned, and the present occasion has certainly been no exception to that rule.

Mr. R. C. Mossman: I have really very little to say about Mr. Taylor's valuable paper except in so far as the first slide is concerned, viz. that which showed the continent of Antarctica as split up into two portions with a strait running between them. Considerable stress is evidently laid on the recent charts of Filchner which indicate an ice barrier, and not land, to the west of Prince Regent Luitpold Land, but on the original charts which I saw a year ago, the position now marked as ice barrier was called land, and it was named after the Kaiser. It is very likely that Prince Regent Luitpold Land continues in the direction of the ice barrier. It is also probable that the land in question is a continuation of Morrell Land, the existence of which is supported by the meteorological observations of the *Deutschland*. These observations, in conjunction with others taken simultaneously at the South Orkney station in lat. 61° S., show a very steep thermal gradient, which bears out the idea that we have to do with continental land situated very little to the west of the winter drift of the vessel. I should like to ask one question, if Mr. Taylor came across many cases of Föhn winds while working in these valleys? The denuded aspect of the lower slopes certainly suggests that relatively warm winds blow frequently.

Dr. J. W. Evans: I am very glad of this opportunity of congratulating Mr. Taylor on the work he has accomplished and the good use he has made of his opportunities.

The recognition by Dr. Smith Woodward of fish remains of Middle Old Red Sandstone types among the fossils brought back by the author from the Antarctic and now exhibited at the British Museum (Natural History), is of profound interest. They represent types which were first described from the north of Scotland and afterwards from the north-west of Russia, in both cases in deposits accumulated under lacustrine or fluviatile conditions. It is remarkable that a similar assemblage should now be met with in the extreme south. By what rivers, that have long ceased to flow, through what lands now covered by the sea, they made their long journey across the world in those remote times, who can say? There can be no doubt, however, that the discovery raises important problems that lie within the province of palæogeography, the geography of the past.

I believe that Mr. Taylor's suggestion that the valleys which he has described to us were formed by the merger of cwms or cirques arranged in succession one behind the other is new, at least in the complete form in which he has stated it.

I notice that he attributes the theory that cwms were excavated by alternations of frost and thaw to Mr. W. D. Johnson and other American authors; but much as I admire their work, I see no reason to give them more credit than that which they have so justly earned. It was in a paper before this Society in 1898 that Sir Martin Conway explained the formation of the great cwms in Spitsbergen by the alternate melting and freezing of water; but while he supposed, and I believe rightly, that this action took place in exposed situations, our American friends contend that it is most active deep down below the surface of the ice, where the great crevasse, usually found at the head of a glacier and known as a "bergschrund," reaches the rock bed, and this, in spite of the fact that in such a situation, variation in temperature must be at a minimum.

I was especially interested in the group of small cwms of which Mr. Taylor showed us a view, because I have described a similar occurrence in the hills of West Somerset near Minehead, where they appear to have been formed at a time when the climate was more rigorous than at present, as a result of the daily melting of the margin of the snow covering the hilltops and the freezing at night of the water that trickled down the slopes (*Proc. Geol. Assoc.*, vol. **24**, pp. 251–252, 1913; and vol. **25**, pp. 100, 103, 1914). As might be expected, they occur on the hillsides that have a southern or western aspect, and are most exposed to the warmth of the sun's rays.

Mr. Lamplugh: Mr. Taylor has laid an admirable series of facts before us, and has told us many things we wanted to know. He has known what to look for and how to describe it accurately. His explanation of the curious features in the valley-forms will, of course, be considered with deference, and whether it be accepted or not, the high value of the observations remains unaltered.

Prof. David has put the problem as to the origin of the larger trench-like valleys very clearly. We have no reason to suppose that these comparatively modern valleys were ever occupied by rivers. Ice comes down them now, and has done so from the first, so far as we know. Yet these valleys have most of the characters that we associate with a drainage-system carved out by running water. Can anything else but ice have formed these valleys? That is a question to which we may expect to have a definite answer as a result of well-qualified explorations such as these of Mr. Taylor.

Mr. Freshfield: Having been concerned many years ago in getting a Committee formed in the Alpine Club to study glacial movements, and having been subsequently connected with the International Commission for the Study of Glaciers, which arose out of that Committee, I have naturally taken a great interest in Mr. Griffith Taylor's description of the Antarctic icestreams. I might refer to many topics of interest raised by his lecture, but there are two reasons why I refrain. The first is, that our time is limited and Mr. Taylor has a good many inquiries to answer; the second is, that being only a glaciologist and no geologist, I hesitate to plunge too deeply into the questions—those burning questions—which are connected with the action of moving ice. At the same time I would point out that it seems to me that the facts we have been given this afternoon are inconsistent with the existence of glacial erosion in the sense in which that phrase is generally understood. Mr. Taylor has told us that he saw "no evidence of glacial erosion in the ordinary sense" in the Antarctic. I should like to ask whether, if that is so, he would explain the features of the country by what may be called "the thaw and freezing theory"? Let us take, for instance, the "Dry valley." Nothing is more instructive than a district over which a glacier has advanced, and from which it has retreated. Now we find this so-called "Dry valley" blocked by great rock-barriers which protrude across it. If the ice dug out the valley, why did it not remove the barriers? Prof. David said he should like an explanation of the deep-cut gorges cut through these barriers. Do not the Alps furnish that explanation? The Kirchet above Meiringen is the best-known example of this combination; there is one below the lower end of theRosenlaui glacier, and another below the Eiger glacier. In all these cases it is obvious that the sub-glacial torrent, while it has been under the ice, has cut a sharp gash through the barriers, which the glacier has flowed over and polished. The side of the gash have been protected by the ice from sub-aerial denudation.

The idea that the Antarctic side-valleys were dug out by glaciers is apparently abandoned by the lecturer. Is it not probable that in the days when the Antarctic was a warm country these valleys were slowly eaten back by water and alternations of thaw and frost in the way Prof. Bonney believes the Alpine cirques to have been excavated? That, at any rate, seems an adequate explanation of the phenomenon. I have ventured to touch on these dangerous subjects, but I will not go any further, nor will I venture to-day to discuss the surface conditions of glaciers, the way in which their face is apt to be modified by water-channels to an extent that makes progress over it extremely laborious. It is strange that the nearest comparison to that surface, as shown to-night, that I know is afforded by the glaciers under Kangchenjunga. There it owes its origin to the rapid melting of the ice and the strong torrents on its surface, which are caused by the burning Indian sun.

There is one point I would ask geologists to take into their serious consideration. Can they not talk English, or at any rate Welsh? I will not object to "cwm," but in the synopsis of this paper, I find a good many terms which are unintelligible to me. Here are a few specimens: "trogtal," "skauk," "riegel." I can only guess at what a "dendritic" or "supine" glacier may be. Surely it is time to adopt a nomenclature which shall be less cosmopolitan. I make this protest not only in my own name, but as a member of the International Glacial Commission. Prof. Rabot, its head, writing a week or two ago to express his hope that the glacial observations of the Scott expedition would be thoroughly gone into, added that he trusted that the time was coming when we should simplify our terms for glacial phenomena, and should learn to use them with greater precision. I desire, in conclusion, to thank the lecturer, Mr. Taylor, for the way in which he combined brevity and clearness. He has told us a great deal and shown us a great deal.

Mr. Griffith Taylor: With reference to Prof. David's remarks, the section in the paper dealing with the possibility of a Trans-Antarctic strait is tentative, and was inserted in view of the general interest in Sir Ernest Shackleton's forthcoming expedition. I think the existence of mountains far to the east of Amundsen's line of march is "not proven," for he was many miles distant. The faulted level-bedded mountains of Victoria Land do not tectonically agree with the Graham's Land range, and the evidence for their union is still very slight.

The presence of a crustal bulge inland, near the Magnetic Pole—and forming an ice divide of greater importance than the Ross sea range—is curiously paralleled by the "warp divide" in Queensland, which is lower than the coastal ranges through which the rivers run.

The fact that the "defiles" are on the north of the valleys indicates their fluvial origin, for all the surface drainage is diagonally across the glacier to the north-east. This is due to the sun under-cutting the ice gullies on the north and so leading the water in that direction.

I do not think river erosion affected the Ross sea ranges. I believe the outlet glaciers descended through cwm notches. Nor do the walls of the Ferrar

The Map to accompany Lieut. Binsteed's paper will be issued in an early number.

and Taylor glaciers show signs of faulting, for the dolente sills, etc., seem to be at the same level on each side.

Prof. David's practical experience of crevasses is greater than mine, and I concur that the directions of wind and of crevasse respectively are important factors in determining the shape of the bridges.

As to Dr. Evans's remarks, geologists owe a debt of gratitude to the American physiographers for insisting on the importance of the sapping effect in the formation of the Rocky mountain cirques. The similarity of shape between the Somerset combes and Antarctic cwms is, in my opinion, more than accidental. I deal chiefly with the region between lats. 77° and 78° S. I hope Priestley, who studied the physiography of the Ross quadrant at two more northern and moister stations, will be able to show us how, and why, the topography there differs from that further south.

As to Mr. Freshfield's remarks, it will be noticed in the synopsis that I do not deny glacial "planation" by the sole of the glacier, in the case of large glaciers under warmer conditions. Put briefly, the Antarctic is not a suitable environment for profound glacial action. In effect, Antarctica is too cold.

With regard to nomenclature, there are only two excuses for introducing new names. Firstly, for the sake of brevity—as in the case of the word "palimpsest"—to define a new concept (if it prove such); and secondly, if there is no other useful word in English. Mr. Freshfield objects to the words trog-tal and riegel. But "Trough valleys" are associated with faults rather than with glaciers. Again, the word "barrier" is already used—very loosely—for an ice-sheet. The word "bar" has at least one meaning to which all respectable explorers should object!

SOME TOPOGRAPHICAL NOTES ON A JOURNEY THROUGH BARGA AND NORTH-EAST MONGOLIA.

By Lieut. G. C. BINSTEED, the Essex Regiment.

Object of Journey.—This journey was made in August and September, 1913, as one of a series in Mongolia by which the writer hopes, were he ever enabled to complete it, to collect sufficient material for a work of reference on this little-known country.

Route.—Briefly, the route was: Hailar—Gandjur—south-west corner of Dalai Nor—mouth of the Kerulen—up the left bank of that river to the southern apex of the great bend 60 miles east of San Beisa Urgo *—due west across the steppes to San Beisa Urgo—up the left bank of the Kerulen to Tsetsen Khan Urgo—thence by the "Middle road" in a generally constant direction straight to Urga—the Mongolyor goldfields on the middle Iro—Kiakhta.

Topographical Divisions of Route.—Topographically this line falls under two sharply contrasted sections, whilst a third narrow transition belt may also be distinguished as lying between the two former, which may be appropriately termed (i.) the plateau, or purely steppe section; (ii.) the Kentei section of mountain and forest with patches of hill steppe.

* Urgo here denotes seat of a prince.

The Plateau-Steppe Section.—In the plateau section the route lay across the north-eastern extremity of that vast elevated region known as High Asia, which on the line Kalgan-Urga maintains a height of 3000 feet to 4000 feet. Thence north-eastwards the tableland steadily drops in proportion as its configuration narrows between its converging containing walls, the Great Khingan on the east, and the Kentei and Yablonoi mountain systems on the north and north-west, till in Barga it averages 2000 feet in height. The whole of this north-eastern wedge of High Asia is formed of monotonous rolling grass steppes. From Hailar to the Senkur Gol (about 500 miles as the crow flies) not a single tree was seen, except in one hollow where from some extraordinary cause a little grove of some fifty stunted trees had grown up. The only vegetation is grass, except that at a few points on the middle Kerulen some low shrubs grow by the river edge.

Streams.—The plateau section is very scantily supplied with flowing surface water. From Hailar to Tsetsen Khan Urgo, besides the Arshun and Kerulen, only one little stream was seen or crossed, namely at the south-west corner of Dalai Nor. No tributary was seen to enter the Kerulen below Tsetsen Khan Urgo. In quotations in the Meng Ku Yu Mu Chi mention is made of thirteen tributaries between Tsetsen Khan Urgo and the Barga boundary—another proof of the desiccation, whatever may be the cause, of this part of Asia. Some 20 miles west of Tsetsen Khan Urgo is the Targhilji Muren, which quite recently used to empty itself into the Kerulen, but of late years has ceased to flow so far. The route crossed it at a point about 15 miles from its former confluence with the great river, at which place it was a rapidly flowing brook, 5 yards wide and 6 inches deep, so that it was difficult to believe the unanimous assertions of the inhabitants that this volume of water no longer survived the short remaining distance to the river. In the Meng Ku Yu Mu Chi this stream is referred to as "at times disappearing and again reappearing." In its upper course it was said by the inhabitants to be a much bigger stream. Its disappearance would seem to be due to the sandy soil which distinguishes this purely steppe area from the mountainous belt in which lies its upper course.

Lakes.—The plateau section has a comparatively large number of exitless lakes and ponds, the water area of which is subject to constant and marked changes, the water often being brackish, salty, or undrinkable. In most cases, the water was occupying much less than what had evidently lately been the entire bed of the lake, while some ponds were almost dry. The beds of such were often covered with deposits of what the Chinese call chien[3] (Giles translates carbonate of soda), which from a distance presented a most glistening appearance in the sunlight. Most of the lakes were very shallow, and formed the haunts of great quantities of geese, duck, and other waterfowl.

Orography.—The hills throughout the plateau section bore the strictly steppe character of grassy downs, and were remarkable for a striking monotony of form and height, especially along the lower Kerulen. An exception was offered by a mountain belt, about 18 miles wide, where crossed by the route, situated on the borders of Dalai Wang and Darkhan Hoshoi Chin Wang principalities, some 90 miles west of San Beisa Urgo. Here bold rocky mountains culminated within 6 miles of the river in peaks which must have been at least 1000 to 2000 feet above the river-bed. From these mountains steep-sided grassy spurs ran down to the valley, at some points narrowing its floor to a few hundred yards in width. The mountains, though rocky, retained the same woodless character as the lines of downs which predominate along the lower and middle Kerulen.

The Kerulen River and Valley.—The route followed the latter river for at least 300 miles of its course, and then later crossed it at a point at least 600 miles above its mouth. It was therefore surprising to find, as one ascended the valley, that the river's volume, breadth, and depth seemed to remain the same. In fact, out of the four places at which it was forded the volume of water was, if anything, greatest at that nearest the source. The above is, of course, due to the absence of tributaries and to the exactions levied by the soil and air upon the river in its long passage through this ultra-dry region. Near a ford (itself 2½ feet deep and 40 yards wide) within a few miles of Dalai Nor, the river in general was only 20 yards wide, flowing between abrupt mud banks 3 or 4 feet high whose tops are flush with the surrounding levels. The water here is muddy, flows briskly, and is at least 6 feet deep, while the bottom is of mud. This description is on the whole characteristic of the whole course up to Tsetsen Khan Urgo. As one ascends the water becomes slightly clearer; the banks vary slightly in height, as does the river in breadth, but for so long a course the degree of uniformity is remarkable. The river frequently splits into two or more channels, which meander a mile or so apart in the broad flat valley floor. This latter alone undergoes great changes in breadth, varying from a quarter of a mile, as as Altan Emel, up to 6 miles or more. On both sides of this level bottom the ground rises sometimes by long gentle slopes, but more frequently by a well-marked line of rounded downs, up on to the rolling steppelands of the great plateau. The outline and relative height of these downs yields nothing in monotony to the rest of this treeless, almost uninhabited, wholly uncultivated, dull grass-coloured landscape.

Communications in Kerulen Valley.—The valley of the Kerulen forms a great natural highway running across north-east Khalkha into Barga. The continuous presence of water, with its attendant good grazing is what determines the direction of communications in this arid region. The traveller along the Kerulen has many alternative tracks open to him. Speaking generally, a track runs in the valley floor on both sides of the river, and, where the latter makes considerable bends, tracks take short cuts across the intervening uplands. On these uplands the distances between wells vary, and the traveller must weigh this consideration in conjunction with his own rate of movement in deciding whether he can profit by the short cut or not. Again, fords enable one to cross from the track on the one bank to that on the other. No navigation exists on the river, though it would seem that at least rafts and barges could be used. The whole track from Hailar to Urga is a first-class naturally worn road, fit for any motor or other heavy traffic, except at one or two passes in the western third of the route and at narrow belts of sand-dunes in Barga, where improvements would have to be made for motor or mechanical transport.

Transition Section.—The purely steppe area may be said to cease about the Senkur Gol, whence commences the transition section, *i.e.* that in which the route crossed the "transition" belt whereby the rolling steppes of the tableland give place to the wooded and mountainous area of the Kentei. The line of this transition belt would appear to run from between the Onon and the Kerulen away to the west-south-west. On the line of the present route, it may be described as extending from Senkur Gol to the immediate valley of the Tola. On entering this section the hills lose the purely steppe character of grassy downs; rocks and steep slopes make a more frequent appearance, and for the first time one sees copses and scattered trees, though as yet exclusively on the northern slopes and chiefly in sheltered gullies. While lakes continue to be frequent, here many valleys also contain running streams.

Kentei Section.—Finally, on reaching the Tola the route may be held to have definitely entered the confused mountainous area known to the geography of our atlases by the misleading and ambiguous name of the Kentei range. This area is itself only a portion of the great region, well watered, well wooded, and mountainous, which is best differentiated by the term North-Western Mongolia, and which in its turn is regionally part of the mountain belt which throughout separates the tableland of High Asia from the plains of Low Siberia.

In the Kentei, the small area here immediately concerned, we find an amazingly tangled mass of mountains which rise to 6000 feet and 7000 feet from valleys whose bottoms vary from about 4000 feet round Urga to about 2500 feet round Kiakhta. Nearly every valley contains a brook, and most of the northerly slopes are covered with wood, while some ridges, especially in the upper and middle Iro basin, are wholly clothed in dense forest. The central knot of this mountain system would seem to lie between the sources of the Kerulen, Onon, Chikoi, Iro, Hara, and Tola, whence long arms stretch out to form the watersheds between these several rivers and between them and the great tableland to the south.*

* It must, however, be noted that one recent writer, Colonel Popoff, in the report on the Moscow Commercial Expedition to Mongolia of 1910, uses the term Kentei in a much wider sense than the above, its usual, application. He analyses the mountain system of north-west Mongolia as consisting of several ranges which all spring from

The chief varieties in the forests here are birch, pine, fir, larch, aspen, and cedar. However, there are also considerable tracts of hill-steppe country in this region, *e.g.* along the lower Iro; in such tracts copses are only met with on the higher hilltops. The valley floors are almost everywhere free of wood. The two landscapes, forest and steppe, are to be seen in close proximity and sharp contrast on the Kuien Gol (the upper waters of the Hara Gol), the left or western basin of which is of hilly steppe; whilst dense forest crowns the bolder range shutting in the river on the east and south-east. This difference makes itself felt also in the nature of the tributaries, those on the right being well supplied and rapid streams, while those from the west often disappear altogether in the grasslands before they reach the Hara.

Maps.—Before proceeding to some details of particular localities a word must be inserted as regards maps. As is universally admitted, the Russian General Staff 40-verst-to-1-inch map in Mongolia is almost useless owing to its amazing inaccuracies, its heterogeneous sources, and the worthless selection of names printed on it. A very welcome addition is the map recently published by I. A. Molchanoff in Tome XIV, of the *Journal* of the Kiakhta Branch of the Imperial Russian Geographical Society, which accurately shows a skeleton of all the streams and roads on the line Urga-Kiakhta at a scale of 1 : 400,000. The Mongolyor Gold-mining Company are carrying out a survey of their mining areas and roads. Lastly, there has just been published under the co-operation of Prof. Kotvich and I. Y. Korostovetz a political map of all Mongolia showing, though admittedly and necessarily only very approximately, the boundaries of every hoshun (principality), a feat never before attempted.

Hailar-Chagan Nor.—To pass to details, for the first 45 miles from Hailar the track runs over almost waterless high-lying undulating grassland, broken at times by belts and patches of sand-dunes less thickly covered with verdure. These dunes are found largely in Barga, especially along the railway from Hailar to Manchuria station and near Gandjur.* The absence of surface water involves also the absence of habitations, and of flocks and herds. If surface water exists elsewhere in the neighbourhood, the Mongols and Barguts are too unenterprising to dig wells except where absolutely indispensable for travellers.

Chagan Nor-Gandjur.—From these uplands the track descends to Chagan Nor, a shallow lake three-quarters of a mile in diameter, and thence

a central knot, Bogdo Ochir Wang, near Uliasutai. The name Kentei he assigns to the whole watershed which, running from Uliasutai eastwards and later north-eastwards into Transbaikalia, separates the Selenga-Orkhon basin from those of the Kerulen, Gobi lakes, and Kobdo lakes. This Kentei of Colonel Popoff's includes in its line the central Kentei knot described above as lying north-east of Urga.

* Borjimski points out that these dunes all run north-west to south-east in the direction of the prevailing winds, and says it is supposed that they are steadily moving eastwards.

past a succession of marshes bordering the Hwaian Gol, which flowing west terminates in another lake at Modon Amjur some 8 miles from Chagan Nor. In this well-watered section yurts, flocks, and herds were almost always in sight. From Modon Amjur the road again rose on to undulating grass uplands which continued to within 2 or 3 miles of Gandjur Sumu (Temple), broken as before by sand-dunes which form a very serious obstacle to heavy traffic at two points, respectively 25 miles (near Ying Gung Temple) and 2 miles before reaching Gandjur. On emerging from the latter belt one finds oneself on a dead-level low plain, dotted with ponds and isolated sand-hills, in the centre of which rises Gandjur Sumu, famous from the fair which annually attracts hither Russians, Chinese and nomads from 1000 miles around.

Gandjur-R. Arshun.—The route of about 55 miles from Gandjur to Lamgur Sumu (on the Arshun not a dozen miles from Dalai Nor) lay chiefly across low flats studded with ponds of bitter and salty water with stretches of slightly higher dry steppe, the latter becoming continuous on approaching the immediate valley of the Arshun. This river averaged 20 to 30 yards in width, flowing between mud-banks which drop perpendicularly for 4 to 5 feet from the bordering flats. The muddy water flows rapidly. The river is chiefly remarkable for its extraordinary wealth in fish, which has led to the development since 1912 of a considerable fishing industry by nearly thirty Russian establishments, whose rapacious methods have, however, already condemned to probable failure an industry which was favoured by exceptional advantages.

Dalai Nor.—The south-east and south-west shores of Dalai Nor consist of low sandy flats which rise in successive terraces as one moves inland. The immediate vicinity of the water's edge for some 40 yards is mud, the water itself being devoid of rushes and very shallow near the shore.* The rise from each terrace to the next is by an abrupt well-marked line of bank only 2 feet to 3 feet high, apparently formed by the lapping of water and such as one sees on a sea-beach. About half a mile from the water on the south-east shore, and possibly as much as 2 miles at places on the south-west shore, there is a much higher line of bank, raising the level by 20 feet to 30 feet. It is at the top of this high bank that one finds the yurts nearest the lake, the lower flats evidently becoming too damp at times for habitation. The sandy soil of the flats is full of small shells, but now supports a thin crop of grass. Great numbers of wild-fowl frequent the lake. The successive banks only support the mass of historical, documentary, and other evidence that the lake formerly occupied a far larger area even than now. Colonel Baranoff, in his pamphlet on Barga, gives as a chief reason for the diminution in the lake the fact that

* Colonel Baranoff says the northern shores are covered with thick rushes. He gives the depth of the lake in the south as from 28 to 35 feet, but in the north he says it is very shallow and freezes solid.

the river Hailar, which until the first half of the nineteenth century emptied itself into Dalai Nor, has since changed its course and now flows directly into the Argun. As a result, Dalai Nor fell so much that it has practically ceased to feed the Argun.

Position of Tsetsen Khan Urgo.—Moving far further west, it may be noted that, as Colonel Novitski learnt in 1906, Tsetsen Khan Urgo requires to be shown far further down stream (the writer reckons about 45 miles) than is shown on the "40-verst" map.

Senkur Gol.—At the crossing of the Senkur Gol, its valley floor was from 1 to 1½ miles wide, richly clothed in grass and marshy in the centre. The stream was 10 yards wide, from 6 inches to 18 inches deep, with a brisk flow over a stony bottom.

Bayin Ulan Range.—Between the Senkur Gol and the upper Kerulen the route surmounted, by the most difficult pass crossed between Hailar and Urga, the historically interesting range of the Bayin Ulan, whose upper slopes were covered with copses of larch, pine, fir and birch, undergrowth of ferns, and outcroppings of rock.

Upper Kerulen.—At the ford over the upper Kerulen the depth was nowhere greater than 2 feet, with transparent water running rapidly over smooth stones with an occasional rock. However, it was obvious that any heavy rain or the melting of snows would render this ford temporarily useless, if not from depth at any rate from rapidity of current. The river was from 35 to 50 yards wide. The valley floor here was far narrower than in the middle and lower course, being in general only a quarter of a mile broad. On both sides rose steep rocky hills scantily covered with poor grass and low dry scrub. By the river-edge grew some shrubs, but no trees were anywhere in sight.

To Urga.—West of the Kerulen and hidden from it by a high but narrow ridge (Mildtzi Ula) stretches a broad, lowlying, and gently undulating plain (Gung Gulutai or Nurinti Tal) on which lie three lakes—Big and Little Gung Nor and Aiyagei Nor—whose diameters vary from a half to 3 miles. From this steppeland the route winds up by valleys over the watershed which hems the Tola in on the south, and which at the various passes over it is known as Burlin Daba or Bayin Daba. Thence the Tola was followed to Urga, where, contrary to expectations evoked by the development of political events, it was found that very little had changed since the writer's former visit at the time of the *coup d'état*.

THE BAGHDAD RAILWAY.*

By Captain S. F. NEWCOMBE, R.E., and Lieut. J. P. S. GREIG, R.E.

THE following is a description of a journey along a section of the Baghdad railway through the Taurus mountains between Dorak and Karapunar, in May, 1914.

* Map, p. 608.

The Baghdad railway proper begins at Konia, where it joins on to the old Anatolian line, and is open at present from Konia through Karaman, Eregli, Ulu Kishla, and Bozanti as far as Karapunar (kilometre 291), this being a small village on the Chakra (Chakit) Su in the middle of the Taurus range. At Karapunar the Chakra Su enters a vast gorge, and the work of tunnelling begins and still remains incomplete. The completed section begins again from Dorak (325 kilometres approx. from Konia) at the eastern foot of the Taurus, and is in working order through Adana to Mamure at the foot of the Amanus range, where another difficult tunnelling section is encountered, which is also in an incomplete state.

The section of the railway here described is the portion between Dorak and Karapunar, and consists very largely (about 18 kilometres altogether) of tunnels, while in addition are considerable lengths of very heavy earthwork on the east side. Work on this section has been going on for some years, but has now been stopped (May, 1914), and will remain so for perhaps a year or two till the Amanus section is through. It is the most costly and difficult section of the line; no rails have been laid or bridges built along it between the two stations yet, and it may take another two or three years to finish. It was traversed on horseback (horse is rather a misnomer for the animals obtained) from Dorak to Karapunar, and is therefore described in this direction.

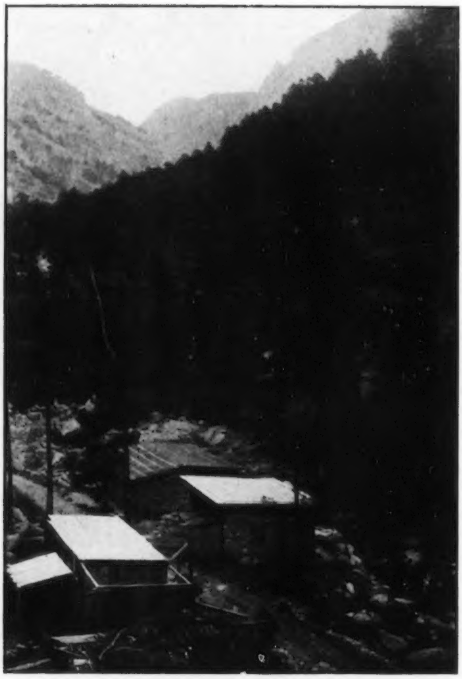
On leaving Dorak, where railhead ends, the bankwork goes up an earth valley for 2 miles westwards to the top of the valley, then bends south along a low spur and makes a long curve around the head of another valley which drains south-east to the Chakra Su; the cutting and bank are already made, but apparently no very heavy works. The country to the north-east is open, undulating plain. After 2 or 3 miles the railway turns north, undercutting into the side of a mountain, under which it now runs for some miles. The line has been mounting gradually, and the *détour* along the spur has given the necessary distance to enable the track to be well up on the side of the mountain, called Hajji Kiri. Here the heavy work begins. First a tunnel, then various banks and cuts with high bridges over the mountain rivulets, with piers 50 feet to 100 feet high; then cutting again for another 2 miles.

All along on the side of this mountain one can see the undulating plain towards Dorak, and the winding Chakra Su after it has left the mountains and has spread out its channels to a wide earth bed. The Amanus range is always visible in the distance, with the Cilician Plain and the sea-coast in the middle distance. Work along this section is not being pushed, and, in fact, for 7 miles from Dorak not much has been done, though there is not enough work to cause any considerable delay. No stone work has been done until Kuchulu is reached. A road passable by carriage has been running more or less alongside the railway bank and below it. Near Kuchulu it forms a U-shape 100 yards across and going back into the steep valley for 300 yards. Here the railway crosses a deep gorge. After this,

GORGE OF CHAKRA SU, NEAR KILOMETRE 296.

GORGE OF CHAKRA SU AND NEW CARRIAGE ROAD CONSTRUCTED BY THE RAILWAY CO. NEAR KILOMETRE 296.

GORGE OF CHAKRA SU, NEAR KILOMETRE 296, ABOUT 5 KILOMETRES SOUTH OF KARAPUNAR, LOOKING DOWNSTREAM.



TEMPORARY VILLAGE AT KILOMETRE 296, NEAR MOUTH OF FIRST AND SECOND TUNNELS.

KARAPUNAR VILLAGE AND NORTH END OF FIRST TUNNEL, TAKEN FROM 1 KILOMETRE BEYOND KARAPUNAR.

the road is cleverly graded high up the mountain, while the railway goes into a tunnel then being drilled (*i.e.* fourth tunnel from Karapunar). Near the tunnel mouth is a stone-built camp with a telegraph office, and [illegible] Haas engineer in charge; while work on some cuttings and short banks of 50 feet high was going on for 1 mile from the camp.

After passing this camp for perhaps half a mile one suddenly comes upon a marvellous gorge some 2000 feet or 3000 feet spread out below; in this is the main branch of the Chakra Su. The road, es ecially after this, is a very fine piece of work undercut in the rock with vertical cliffs below. Where necessary (and these points are frequent) wooden balustrades prevent the unwary falling an uncomfortable distance. After another half-mile there is a cable lift railway down to the tunnel at this point, perhaps 1000 feet above the stream; the tunnel here opens for a distance of perhaps 200 yards, forming the mouths of tunnels 3 and 4. Looking from the road upstream one can see a wonderful zigzag path from a village 1 mile ahead, winding down over 1500 feet to a broken space in the cliffs where an air shaft has been let into the tunnel; the path then continuing its zigzag down to the stream.

The carriage road continues to the village, which is perched on a high eminence, and consists of a few stone buildings and shanties erected for the engineers and a guard of soldiers, with a store or two. The village is called Bedernadik, and is 303 kilometres from Konia. Unless the traveller has a pass here, the sentry is liable to stop him, since the road is private and belongs to the railway company. A few well-chosen words in French to an Austrian, who could only understand Italian, and the acceptance of a cigar, were sufficient to get us through. Thence the road descends in sharp cusps, impossible to a loaded carriage, down to the railway, where there is a tunnel mouth. The road follows the railway for a few hundred yards, and perhaps 800 feet above the stream. It was getting dark when this part was seen, but the mouth of the tunnel (No. 2) towards Bozanti was apparently not started at this end and certainly was not at the other. The road then winds along, cut into vertical cliffs, in a narrow gorge of the most impressive and romantic description, seen as it was after dusk with a crescent moon, on either side the cliffs rising sheer to the snow-line. The road itself is a very fine piece of engineering, in two places cutting through vertical cliffs by small tunnels 100 feet long. It gives one a feeling of respect for the engineers who carried out the extremely difficult work of survey and construction.

By degrees the road gets down to the stream level, and after 7 miles from Bedernadik is another working camp, for tunnels Nos. 1 and 2, or kilometre 296. Here we spent the night on the ground, in order to see the work by daylight. Work was going on all night, and electric arc lights were used at the tunnel mouths. Only the tunnel (No. 1) between 296 and 293 was being worked; the one (No. 2) between 296 and 302 was not begun. The gap between these tunnels was only some

200 yards, and the line here crosses a stone-built culvert with about 120 feet bank over it, and about 250 feet above the stream level.

Hence to Karapunar the road follows close to the stream, and after 2½ kilometres the valley opens out to 1 or 2 miles wide. Here are quarries, with stacks of cut and shaped stone; then just above the village (a line of stone shanties) is the tunnel mouth (293 kilometres), with a line of light railway and a contractor's engine working. Herr Gallus and several engineers of Section III. have their houses and offices here. It was difficult, however, to get any other information than what could be seen on a hurried journey.

The head office is apparently at Adana, though a considerable staff is kept at Karapunar. One kilometre from the offices is Karapunar station, at present only a wooden shanty. Here the line is only a few feet above stream level, and the valley widens out with a few cultivable patches, snow-topped mountains surrounding it; beautiful scenery still, but similar and more beautiful can often be seen in Switzerland. The gorge, however, between kilometres 296 and 303 is perfectly wonderful, especially at night, and the future passenger who travels by train through tunnels will miss everything worth seeing. The work need only take two or three more years to finish. Three out of the four long tunnels south of Karapunar have been already started; the second tunnel not yet begun.

Beyond kilometre 310 not much has been done, nor was work going on. However, thence to Dorak the work is not serious. It is reported that all work had ceased from July. A sum of £200,000 is reported to have been spent on making the fine carriage road alone along the railway route, to enable the tunnels to be reached; a vast sum will be necessary to complete the railway.

This road, of course, follows quite a different valley to that through the famous Cilician Gates (Pylæ Ciliciæ), which lie further to the west. The new and old roads diverge near Bozanti, the new one going by the river gorge to Dorak and thence by railway to Yenije; the old one from Bozanti leads through the Cilician Gates (Gulek Boghaz) to Tarsus, and thence by rail or road to Yenije and Adana. The new trace gives a much shorter road journey to reach Adana from Bozanti.

REVIEWS.

ASIA.

Researches in Siam.

'Durch König Tschulalongkorns Reich.' Eine deutsche Siam-Expedition von Dr. Carl Curt Hosséus, Inspector Ingeniero Agronomo der Sektion "Estaciones experimentales" im Landwirtschaftsministerium der Republik Argentinien. *Mit 125 Illustrationen und einer Karte.* Stuttgart: Strecker & Schröder. 1913. *Price M.15; bound M.18.*

This book is the record of a journey made from 1904 to 1906 to investigate the flora of Siam. Dr. Hosséus ascended the Menam river and the Meping to Chieng-mai, then proceeded northwards to the Burmese Shan states, crossed to the Mekong, which he descended to Chieng-rai, and returned thence to Chieng-mai. In fact, he seems to have followed much the same route as Lord Lamington, but owing to differences in the spelling of names and the absence of a map it is not easy to ascertain his exact route. He noticed the occurrence of the coconut palm, generally supposed to be confined to coast lands, for a considerable distance up the Menam. To the south-west of Chieng-mai he ascended the Doi Anga Luang, the highest mountain in Siam; the culminating peak, to which he gave the name of Richthofen, rising to 8430 feet. Also near Chieng-dow he ascended the mountain of the same name, with three peaks, of which the highest is 7280 feet. He was therefore able to observe the flora, not only in the valleys, but at all altitudes. Besides general botanical information he has also much to say on teak forests and tea, the customs of the Karens, Laos, and Shans, their industries and religious rites, etc. Dr. Hosséus has made considerable additions to the knowledge of the Siamese flora, and has written an interesting book of travel.

'Die Pamirtadschik.' Von Dr. Arved v. Schultz. (Giessen: Alfred Töpelmann. 1914. Pp. 96. *Map and Illustrations. Price M.4.*) Dr. von Schultz visited the Pamir in 1911–12, with the pecuniary assistance of the Museum für Völkerkunde in Giessen, and this pamphlet is a number of the publications of the Museum. He describes the social condition of the Tajiks in the Pamir, their occupations, houses, implements, decorative arts, and musical instruments, with numerous illustrations. Their original Aryan civilization is modified by the influence of later Mohammedan Iranian elements, and in recent years by contact with the Russians. The geography and history of the Pamir are briefly sketched, and a bibliography is appended.

AFRICA.

The Bakongo.

'Among the Primitive Bakongo.' By John H. Weeks. *Illustrations and Map.* London: Seeley, Service & Co., Ltd. 1914. 16*s. net.*

The author of this book, who has spent thirty years in Equatorial Africa, is well known as an authority on several of the tribes of the Congo region. In the volume under notice he deals with the Bakongo, the inhabitants of the region of Portuguese West Africa known as the kingdom of Kongo. These people have been long in contact with Europeans, and it is instructive to note in Mr. Weeks' narrative precisely how this contact has affected them. They will put on gaudy uniforms, adopt sonorous Portuguese names, go to "battle" with fearful and wonderfully made trade guns (which rarely injure any but the users) and drink foreign spirits—but in every essential they cling to their own way. Doubtless these ways are modified by time and circumstance—Mr. Weeks gives good reasons for believing that the institutions of primitive peoples are not so immutable as is often assumed—but the fact remains that four hundred years' contact with European civilization has left the Bakongo, if not unspoiled, still in the child stage of development.

Mr. Weeks writes alike for the student of anthropology and for the general reader, and he does so with a sense of humour and with a sympathetic understanding of the mind of the Negro. He tells many a good story, and he has the gift of word-painting when describing river and jungle. The whole atmosphere of the book is African.

F. R. C.

AMERICA.

Peru and Ecuador.

'Reise in Peru und Ecuador.' Ausgeführt 1909, von Wilhelm Sievers. München und Leipzig: Verlag von Duncker und Humblot. 1914. *Numerous Illustrations, Maps, Figures, and Sections.* Pp. 411.

The author, who is well known as an explorer of Venezuela and Colombia, undertook this journey with the primary object of ascertaining whether the cordilleras of northern Peru and Ecuador, like the sierras of Venezuela and Colombia, had been more extensively glaciated during the Quaternary age than at present. At the same time he investigated the geology and structure of the Andes in these countries, took meteorological observations, and collected plants. Dr. Albert Peppler, Th. Reil, and Prof. N. Bergt have furnished reports on his meteorological and botanical material and his barometric readings for the determination of heights.

The Andes within the sphere of Dr. Sievers' work consist almost everywhere of two cordilleras—the western, built up of sedimentary rocks with intrusive porphyritic material; the eastern, of crystalline schists, old eruptive rocks, Palæozoic, and, in parts, Mesozoic formations. Recent, still active, volcanoes are confined to the western cordillera, except in Ecuador and southern Colombia. These mountains are described with considerable detail under twelve subdivisions. He found valley terraces, lakes, and trough valleys of undoubted glacial origin, and concludes that there were two periods of glaciation, during the first of which the ice descended to about 11,000 feet (3400 metres), and during the second to 12,800 feet (3900 metres), figures which agree very well with those of Hans Meyer for Ecuador and Hauthal for southern Peru and Bolivia. The present limit of glaciation is about 15,200 feet on an average. Whether precipitation or temperature has the greater influence on glaciation in this region is a question which has yet to be investigated. Special chapters are devoted to the climate, the distribution of vegetation, useful plants, their cultivation and distribution, and commercial regions and means of communication.

River Surveys in Southern Brazil.

'Exploração do Rio Grande e de seus Affluentes.' Commissão Geographica e Geologica do Estado de S. Paulo. São Paulo: Typ. Brazil. de Rothschild & Cia.: 1913. Pp. 44. *Numerous Maps and Illustrations.*

This is the official report of the survey of the Rio Grande in the northern part of the province of S. Paulo, Brazil. The river is formed by two headwaters, the Rio das Mortes and the Rio Sapucahy, rising in the Serra da Mantiqueira, Minas Geraes. One of the parties sent out surveyed the river from the tributary Canõas down to the mouth of the Prado, a distance of 143 miles; another the lower section to the confluence with the Paranahyba where the two rivers form the Paraná. Other parties explored the large tributaries Pardo and Turvo, and the Rio S. José dos Dourados, which enters the Paraná farther south. The course of the Rio Grande is obstructed by numerous falls and rapids, so that navigation is possible only in small sections. Its value lies in the immense hydraulic power due to the large difference of level. In the lower section, assuming the discharge to be about 44,000 cubic feet per second, the total energy is 3,680,000 horse-power, of which 1,620,000 at the three falls and three rapids is practically available. The geology of the neighbourhood of the river was investigated. Trap occurs along most of its course; other rocks are sandstones and crystalline schists, the latter occurring in the upper part. The gravels are auriferous, but no rich deposits were found. Meteorological observations were taken and collections of the fauna, both living and fossil. The discovery of a species of Pleiodon in the lacustrine deposits is of great interest in relation to a former connection of South America with Africa.

The volume contains a large number of maps—a general map and sectional maps on the scale of 1 : 50,000, plans of the chief falls and rapids, and a geological map—besides photographs of scenes on the river.

'Ecuador.' By C. Reginald Enock. (London: T. Fisher Unwin. 1914. Pp. 375. *Maps and Illustrations.* 10*s.* 6*d. net.*) Among the earliest volumes in Mr. T. Fisher Unwin's South American Series were 'Peru' and 'Mexico,' by Mr. C. Reginald Enock. One of the latest, 'Ecuador,' is by the same author. Like other volumes in the series it is a fairly comprehensive monograph, and certainly brings together a fuller collection of the main facts about the country described than is to be found within the covers of any other single book published in this country. It may be noted that Mr. Enock, while admitting considerable grounds for Guayaquil's unenviable reputation in matters of health and comfort, says that conditions have improved of late years, partly owing to the advent of the Americans engaged on the railway. An account of the Galapagos islands is sandwiched between chapters on the natural history and the antiquities of Ecuador. There is a bare outline map of the islands in the text. A more elaborate double-page map of Ecuador at the end is commendable for its clearness.

GENERAL.

Old-Time Travel.

'English Travellers of the Renaissance.' By Clare Howard. London: John Lane. 1914. Pp. xvii., 233. *Illustrations.* 7*s.* 6*d. net.*

This book was written in 1908–10 while the authoress was staying at Oxford as Fellow of the Society of American Women in London. It is not merely a collection of incidents and anecdotes from the writings of Elizabethan and Jacobean travellers, but a survey of the essays which were addressed to the gentlefolk of those days, enlarging on the advantages of travel and residence abroad, both for purposes of study and for the general increase of knowledge and culture. The number of such 'Instructions for Forreine Travell,' with their rules for conduct and their warnings against the temptations of foreign cities, is in itself a proof of the wide extent of the custom advocated. The subject was touched upon by E. S. Bates in 'Touring in 1600,' published three years ago, a work to which the authoress of the present book makes no reference. As she says, however, few writers have interested themselves in this branch of literature. Most of the essays are rare and have never been reprinted. She herself has not attempted anything in the nature of reprints, her plan being to comment on whatever in each essay was new or showed the evolution of travel for study's sake. The range is from "The Beginnings of Travel for Culture" to "The Decadence of the Grand Tour." It is a scholarly work, replete with bibliography and index, and, being lightened with stories from biography and history designed to show the sort of traveller to whom the essays were addressed, it provides entertaining as well as instructive reading. There are reproductions of a dozen old prints.

History of Geography.

'History of Geography.' By J. Scott Keltie and O. J. R. Howarth. Pp. 154. *Maps and Illustrations.* London: Watts & Co. 1913. 1*s. net.*

"The whole structure of geography rests upon two great pillars—upon exploration and upon measurement," and the authors trace in outline the familiar story of the expansion of the known world, and also describe the developments which have occurred in connection with surveying, cartography, and geographical theory.

The book is noteworthy for the skill with which the essentials of the story are set forth in true proportion to the exclusion of less important details, the result being to supply as striking a picture, within equal compass, of the progress of geography through the ages as has yet appeared. Crowded into these few pages there is much matter of surpassing interest, which no teacher of geography can afford to neglect, and an effective reply is provided by the whole book to those who contend that there is little in geography beyond topographical information, a reply which is summarized in the concluding paragraph: "The application of geographical method is either essential or at least valuable in every branch of natural science; in itself it fulfils functions which the other natural sciences, taken individually, do not, and that is its justification."

B. C. W.

Drake's Voyage round the World.

'New Light on Drake: a Collection of Documents relating to his Voyage of Circumnavigation.' Translated and edited by Zelia Nuttall. London: Hakluyt Society. 1914. *Facsimile Maps and Illustrations.*

The second circumnavigation of the globe by Sir Francis Drake was one of England's greatest nautical achievements. Yet it has been, up to the present time, most unfortunate as regards its history. The great navigator and his expedition have been misrepresented, especially by his own countrymen. Drake's own journal was lost. We have no account of the voyage either from Drake himself or from any member of the expedition who was capable of writing an authentic narrative.

There are the notes of Francis Fletcher, the chaplain, for the first part of the voyage, who clearly shows his enmity to the commander of the expedition, and of whom Drake wrote that he was "the falsest knave that liveth." The other existing document in which the voyage is described has the signature of John Cooke, who was a man on board. But it is clearly a very clever fabrication, at least as regards Doughty's trial, intended to mislead, and showing a strong bias against Drake. With the use of these two manuscripts, and probably some others, a cousin of Sir Francis Drake compiled and published in 1628, his work entitled 'The World Encompassed.' This work was very ably edited by Mr. W. S. W. Vaux, for the Hakluyt Society in 1854, together with the full texts of the Fletcher and Cooke manuscripts and the narrative of the voyage of Winter's ship by Edward Cliffe, from Hakluyt. The narratives of Fletcher and Cooke are very misleading.

The result of this hostile evidence, with no witness on the other side, was that Drake was popularly believed to have been a rough seaman, with no manners and little knowledge of navigation; that his voyage was a ruthless piratical venture; that he wrongfully executed Doughty; and that he was guilty of robbery and of much cruelty to the Spaniards he captured. This was the popular view. There were always men of more discernment, such as Mr.

John Barrow, Admiral Burney, my old friend Vaux, and Mr. Corbett. Still Drake was popularly held to be a rough, ill-mannered, and ruthless pirate.

The complete refutation of these erroneous ideas has not come from friends or countrymen, but from the testimony of candid enemies. The first glimmer of light is due to Don Manuel Peralta, who published the letter from Don Francisco de Zarate to the Viceroy of Mexico, in his work on Costa Rica (1883). It was quoted by myself and one or two others, but has never been translated until now. It disproved one calumny of Drake's countrymen—that Drake robbed Zarate of his personal effects.

But it was reserved for Mrs. Zelia Nuttall to throw the "new light on Drake." The talented Aztec antiquary, whose work in that deeply interesting field of research is well known, was conducting some of her investigations among the archives at Mexico, when she came upon a document relating to the voyage of Sir Francis Drake. Her interest was aroused, and she eagerly continued her search for documents on the same subject at Mexico with complete success. She then went to Spain and made researches at Simancas, Madrid and Seville, at Florence, in the "Bibliotheque National" at Paris, bringing her great experience among manuscripts of that period, her talent for discrimination, and her ability to bear upon a subject in which she had become deeply interested. She discovered no less than sixty-five manuscript documents relating to Drake's voyage.

Not the least valuable of these documents is the deposition of John Oxenham to the Inquisition at Lima. Few men knew Drake more intimately. His evidence was that Drake was a very good mariner and pilot, and that there was no better in England. The object of his voyage would be to form a settlement and to make discoveries, especially of a strait believed to exist in the far north. It is true that Drake intended, if possible, to recover as much treasure as had been robbed from Hawkins by the Spanish Viceroy Henriquez,* but the main object of the voyage was discovery. Drake was the discoverer of the cape since called Cape Horn, the importance of which discovery was ably pointed out by Mr. Julian Corbett in his speech at our commemoration of the reign of Queen Elizabeth in 1903.† Drake also sought for the Strait of Anian, and discovered the west coast of North America from Cape Mendocino to 46° N. So much for the false statement that his voyage was a mere piratical cruise. It was, mainly, an important and successful voyage of discovery.

One of Mrs. Nuttall's most important discoveries is the log of Nuno de Silva in the Seville archives, where it had been left unheeded for 330 years. This Nuno de Silva was the pilot of a vessel captured by Drake, and was a prisoner on board Drake's ship, messing with the captain, for fifteen months. During the whole of this time he kept a log, of course, clandestinely. Mrs. Nuttall found this extremely interesting document in the archives at Seville, written in Portuguese, and in very illegible characters. She has taken great trouble to give an English version, first obtaining the able assistance of Mr. Edgar Prestage, and of two eminent Portuguese palæographers to obtain a correct transcription, and then translating the text, jointly with Mr. J. A. J. de Villiers, the Secretary of the Hakluyt Society. Its importance will be understood when it is remembered that this is the only existing log of any part of Drake's voyage. From Nuno de Silva we learn that, as his authority for the

* "I am not going to stop until I have collected the two millions that my cousin, John Hawkins, lost at San Juan de Ulloa."

† *Geogr. Jour.*, **21**, p. 605.

execution of Doughty, Drake placed his commission from the Queen on his head, and then read it. The concocters of the document signed by Cooke, thinking that it must be known that something was read, cunningly asserted that the papers then read were letters from the Earl of Essex. This is absurd, and the matter is settled by the evidence of Don Francisco de Zarate, to whom Drake showed his commission. This ought finally to set at rest any attempt to accuse Drake of any want of authority or irregularity in the execution of the mutineer Doughty.

The charges against Drake that he was a cruel and unlearned pirate are completely refuted by the depositions of the Spanish prisoners he landed. These depositions, discovered by Mrs. Nuttall, are extremely interesting and important. They prove that Drake knew the Spanish language, and that his bearing was that of a well-bred gentleman. He was exceedingly hospitable and thoughtful of the comfort of his prisoners. Not a single Spaniard was killed throughout the voyage. Mrs. Nuttall thinks that there is some evidence that Sir Francis was one of the pages who accompanied Jane Dormer to Spain, on her marriage with the Duke of Feria. This would account for his proficiency as a linguist, and perhaps for his courtly manner. All his prisoners, without any exception, render homage to Drake's great skill as a navigator. Far from having robbed Don Francisco de Zarate of his private property, he gave that accomplished Spaniard a handsome present. Zarate was a gentleman of position and the scion of an ancient family in Alava. He was well able to form a sound judgment of his captor, after having had several conversations with him. The account of the internal economy of the ship, derived from the depositions of Spanish enemies, is most interesting. The meals in the cabin were served in great state, with a band playing. The captain's messmates were the gentlemen volunteers, including such names as Fortescue, Cary, Eliot, Hawkins, and Drake's own young cousin and brother. The performance of divine service by Drake himself is described. There is also clear evidence that Drake kept a journal carefully illustrated, with sketches of coasts and headlands, and coloured drawings of new plants and animals. He is said to have constantly been in a cabin, with his young cousin John Drake, drawing and painting in this journal. Alas! that it should be lost to us.

Mrs. Nuttall, in her 'New Light on Drake,' has not only swept away a pile of calumny and misrepresentation: she has placed Sir Francis Drake in a much higher niche in the temple of fame than he held before. It is almost a different man that the depositions of his Spanish enemies prove to have led the immortal voyage of circumnavigation. The volume is thoroughly well edited, the introduction is not too long, and exactly what was needed. A deep debt of gratitude is due to Mrs. Nuttall for her indefatigable industry in bringing these documents to light, and for the zeal and ability she has devoted to a task of no small difficulty. She has cleared the fair fame of a great navigator for all time. C. R. M.

'From Russia to Siam.' By Ernest Young. (London: Max Goschen. 1914. Pp. xii., 328. *Illustrations.* 10*s.* 6*d. net.*) Mr. Young is already known as the author of books on Siam and Finland. He is a schoolmaster who prefers the byways to the highways of tourist travel. In this book he has brought together some forty "sketches of travel in many lands." They all relate to Europe or the Far East, and some have already appeared in periodicals. They are arranged in rather inconsequent fashion, beginning with Russia and ending with Finland, while in between the reader is taken to Siam, brought back to Europe, and then sent "Somewhere East of Suez." They provide, however, pleasant and varied reading, and the illustrations are good.

THE MONTHLY RECORD.

EUROPE.

Clare Island Survey.—Parts 6 and 7 of the Clare Island Survey Reports, dealing respectively with the climatology and geology, have been recently issued as parts of vol. **31** of the *Proceedings of the Royal Irish Academy*. The survey of the fauna, flora, geology, climate, etc., of the island and adjoining mainland of Co. Mayo was carried out by over one hundred specialists during 1909, 1910, and 1911 in order to furnish a study of a typical area of the west coast of Ireland—a region which affords some of the most interesting faunistic and floristic problems in Europe. As regards climate, the report on which has been prepared by Mr. W. J. Lyons, the following elements are considered: winds, barometric pressure, air temperature, humidity, rainfall, and sunshine. The author acknowledges assistance in the preparation of the report from the Department of Agriculture and Technical Instruction for Ireland, the Board of Irish Lights, the London Meteorological Office, and British Rainfall Organization. The very pronounced oceanic character of the climate is reflected in the fact that the highest mean temperature, 58°·2 Fahr., occurs in the early autumn month of August, although the mean for July is only 0°·1 less. The analogy, however, of the greatest cold being deferred till the early spring does not quite hold, for although the mean minimum temperature is lowest in February, the lowest day and night mean of 42°·8 occurs in January as against 42°·9 in February. The absolute maximum air temperature was 82°·0 in June, 1887, and the minimum 20°·0 in January, 1894—one may suppose during a spell early in the month when *maximum* day temperatures below that figure were being registered in London. The rainfall study of the island is not very complete, but the number of rainy days exceeds two hundred a year, whilst the total annual precipitation apparently falls a little short of 50 inches. The geological report, which is handsomely illustrated, is drawn up by Mr. T. Hallissy. The glacial history of the island is thoroughly discussed, as well as its relation to the neighbouring mainland in past and present time. The centre of Ireland, like the highlands of Scotland, appears to have formed a subsidiary focus of ice-distribution during the period of maximum ice-development in Scandinavia, and it was at this time that Clare island and the Clew bay area were overwhelmed by the central Irish glacier which invaded the district in a west-south-westerly direction. The area of Clare island is slightly less than 6⅓ square miles. The surface is rugged, the irregularities of the ground having been determined by the differential weathering of the rocks, the soft shales giving rise to deep valleys and depressions while the more resistant grits stand out as well-defined knolls and ridges. The hill of Croaghmore (Knockmore) is 1520 feet high, whilst one of the cliffs on the coast reaches the formidable height of 900 feet. The island is drained by several small streams, and there are a few lakes. Chief among the various superficial deposits is the boulder clay, which rests on the low rock platform which extends inland from the sea-margin for various distances up to about a mile. The form of the ground in the boulder-clay region is hummocky, with the hollows between the drift-knolls occupied by little flats of peat or alluvium. The best sections of the boulder clay occur in the north-east of the island, where the erosive action of the sea has cut cliffs in the deposit from 40 to 70 feet high. At

Rooaunbeg, to the south-east of Knocknaven hill, the deposit has taken the form of a longitudinal mound or drumlin ridge, having its longer axis oriented in the direction of the principal ice-movement, constituting a prominent landmark.

Rainfall Statistics of Prussian Provinces.—We have received Nos. 261, 262, and 270 of the *Veröffentlichungen des Königlich Preussischen Meteorologischen Instituts*, constituting a discussion by Dr. G. Hellmann of the rainfall charts of certain provinces of Prussia. Each number contains charts of the mean annual and the mean monthly rainfall of the respective provinces on the basis of twenty years' observations, 1891–1910 or 1892–1911. The different aspects of rainfall study, viz. quantity, number of rainy days, excessive falls in short periods, etc., are all discussed; but it can hardly be said that the rainfall survey of Germany rivals in completeness that of the British Islands, as illustrated in the handsome annual volumes of "British Rainfall." The wettest day of the period in Berlin was April 14, 1902, when 5·7 inches fell, an amount greater than for any other station in the province of Brandenburg. This amount was, however, exceeded by that which fell in a thunderstorm at Wernigerode in Saxony, on June 8, 1905, amounting locally to 9·2 inches. Some interesting facts are given concerning the snowfall of the regions in question. To take Berlin, the average number of days with snow or sleet in the year is 34, the average date of the first snowfall being November 14 and of the latest, April 10. The proportion which the snowfall bears to the total annual precipitation is 13 per cent., but in January and February it is 41 per cent. This latter figure strikes one as remarkably low in view of the fact that the mean air-temperature of those months is about 3° Fahr. below the freezing-point. The interpretation of the anomaly is evidently this: winter temperatures markedly above the freezing-point in Berlin are associated with, and indeed largely caused by, rain in a more definite manner than in London, where the mean January temperature is 10° higher. Hence the 59 per cent. of rain occurs on the less numerous occasions when the Berlin temperature is above the freezing-point, and the 41 per cent. of snow during the longer period of freezing temperatures.

The Battle of Nieuport, 1600.—The hostilities that have raged round Nieuport and along the course of the Yser during the past few weeks remind us that this is not the first time that this quiet little Flemish town has figured in the annals of British military history, for in 1600, towards the close of Queen Elizabeth's reign, there took place a sanguinary and hard-fought battle between an army of the States-General under Prince Maurice of Orange and a Spanish army under the Archduke Albert. An English contingent of 1600 veterans under Sir Francis Vere played a valuable part in the battle, and practically decided the fortunes of the day. A graphic account of the battle was written some years ago by Sir Clements Markham, after a careful scrutiny of the battle-field itself in the dunes, and his article, illustrated by a large-scale plan of the battle, will be found in the September number of *Ocean Highways* for 1873. The subject is also dealt with in his book 'The Fighting Veres,' a copy of which has been presented by him to our Library. Even allowing for the immense difference between hostilities of the present day and those of three hundred years ago owing to the development of armaments and numbers, the study of modern military movements on old battle-fields possesses an interest which cannot be denied. The ensuing siege of Ostend, which lasted from 1601 to 1604, forms the subject of another article by Sir Clements in the same volume of *Ocean Highways*, p. 370.

ASIA.

An Early Visit to the Abor Country.—In connection with recent dealings with the Abor tribes, it is of interest to note that one of the first accounts of their manners and customs is to be found in the work of the French missionary, Nicholas Michael Krick, describing his first expedition to South-East Tibet in 1852–53. In view of the comparative scarcity of the book (our Library does not possess a copy), the Rev. A. Gille has contributed to the *Journal and Proceedings of the Asiatic Society of Bengal* for February, 1913, a translation of the chapters describing his experiences and observations among the Abors. It may be remembered that Krick, with his fellow-missionary Bourry, afterwards made a second attempt to penetrate into Tibet by the upper Lohit, but was with him murdered at Same, on the Zayul Chu. As this place was reached from the other side by A–K, during his great journey of 1879–82, without the passage of any large river further east identifiable with the Tsang-po, the journey of Krick and Bourry supplied a virtual proof of the identity of the latter with the Brahmaputra, as pointed out by Sir H. Yule at the time.

AFRICA.

Transliteration from the Arabic in the Egyptian Survey Department.—The difficult question of deciding on a system of transliteration of Arabic geographical names has lately been settled, after careful consideration for some years, by the Egyptian Survey Department, which has finally adopted a series of rules as a result of the labours of a committee formed for the purpose. From 1894 onwards attempts have been made to solve the problem, but the first schemes were of a somewhat general character, based on that of our own Society, and hardly took sufficient account of the special points involved in the case of transliteration from the Arabic. The committee spoken of was formed, in 1910, to thoroughly consider the question and suggest improvements, and a revised set of rules was drawn up and printed in the *Cairo Scientific Journal* for August of that year. The committee has since continued its labours, further modifications having been considered, and the result has been the definite adoption of a system corresponding, with slight modifications, with that used by Mr. J. S. Willmore in his book 'The Spoken Arabic of Egypt.' The general features of the system are outlined by Mr. C. A. G. Mackintosh (who appears to have taken a leading part, in consultation with others, in the work of producing the scheme) in the *Cairo Scientific Journal* for July, 1914. The principles followed appear to be eminently judicious. All aim at that elusive object—an acceptable *international* system—is wisely avoided. It is thought that as the system will be used chiefly by English or English-speaking people, it should be based on the English rules of orthography and pronunciation, recourse being had to certain conventions and symbols to represent sounds for which there is no English equivalent. Continental scholars will naturally expect the system to be an English one, just as one adopted (say) in Algeria would naturally be French. The four main requirements are laid down as follows: (*a*) to provide a pronunciation resembling the Arabic as closely as possible; (*b*) to enable the reader who knows Arabic to recognize the correct Arabic spelling of each word; (*c*) to use the fewest and simplest symbols possible; (*d*) to be consistent. Of the means to be employed to meet the requirement (*b*) the most important is the use of dots below the letters to distinguish the different Arabic forms corresponding to the English letters *t*, *d*, *h*, *s*, and *z*. These may be neglected by the ordinary reader of the names, but will enable the Arabic student to correctly reproduce the original. The circumflex is now used consistently to denote all long vowels, whereas by the rules of 1910 it was used only over a vowel in a stressed syllable. It does not appear whether the attempt to indicate the stress is now entirely abandoned: if this is the case, it is perhaps to be regretted. The greatest difficulty encountered is that of the gutturals, it being necessary to distinguish the two Arabic letters vulgarly represented, both in pronunciation and writing, by *k*. This letter is retained for the true *k* (the Arabic *kaf*), while the other sound is denoted by *q* (as in "Qena," "Qoseir"), though it is recognized that this is a compromise, for in Upper Egypt the letter has the sound of a guttural *g*. The rough breathing (ʻ) is retained for the Arabic letter commonly so represented, though this was omitted altogether in the original rules. Contrary to the decision in 1910, the article will in future be assimilated to the first letter of the main word, if so pronounced; thus, "Kom el Nagar" becomes "Kôm en Naggâr." Apart from the differences above referred to, the rules as printed in full in 1910 would appear to hold good. The new system will be used in all the Survey Department's maps, and it is hoped that it will in time be adopted by all Government offices.

Site for New Capital of Nigeria.—The October number of the *Colonial Journal* quotes from a recently issued Sanitation report for Nigeria some remarks on the site chosen for the new capital of the Protectorate and the reasons which led to its selection. Although some difference of opinion has naturally prevailed, it is felt that "for administrative purposes it is necessary to be near the places where the hard spade work has to be done and the results watched with vigilance." The importance of Lagos, which might seem threatened by the choice of an inland site, cannot but be raised by the developments, railway and other, which are opening up the Northern Provinces. The site is at Yaba, near the point where the railway crosses the Kaduna river, at an elevation of over 2000 feet. It enjoys the important advantage of a dry atmosphere, and the nights feel cool during the greater part of the year. Most of the soil is good, and there is an excellent water-supply from the Kaduna, whilst, as a cattle-refuge during the rains, the locality gives promise of a fresh milk supply. A more elevated site would have the disadvantage of offering too sudden a climatic contrast to those making rapid journeys to it from the lowlands, while that selected seems to constitute the happy medium. It contains ample good ground for expansion. At the Kaduna bridge, some 2 or 3 miles from the chosen site, it is proposed to construct a new railway headquarters.

AMERICA.

The Blocking of the Panama Canal.—The following note has been sent to us by Dr. Vaughan Cornish: "After being opened for commercial traffic and used by a good number of ships, the Panama canal has been blocked by a landslide. It is expected that the removal of the obstruction will only be a matter of days, but the occurrence shows the correctness of the view which I maintained at the meeting of the Society on May 11, viz. that, though ships might safely pass through the canal this year, their return by the same route could not be counted on with certainty. The recent slide occurred on the east side of the canal on the northern part of Gold hill, and it is stated that a portion of the erupted rock of which the core of the hill is composed has given way. If Colonel Goethals, the Governor of the canal, publishes full details of the occurrence, it will be possible from the maps and plans which we possess here to form a reasoned opinion upon the immediate prospects of the waterway, but if the policy of reticence is continued the inevitable result on this side will be a continuance of the feeling that things must be in a bad way if they are too bad to be talked about. The feeling may be unreasonable, but, if so, that is the fault of the authorities for withholding the detailed information upon which alone a reasoned opinion can be based."

POLAR REGIONS.

Stefánsson's Arctic Expedition.—Beyond the bare announcement that Stefánsson had started early in the present year on his proposed northern sledge journey (cf. *Journal*, vol. **43**, p. 448), no news of his movements since the winter appear to have come to hand until September, when the meteorologist of the expedition, Mr. Burt M. McConnell (whose exertions for the rescue of the survivors of the *Karluk* from Wrangel island were referred to in the October number, p. 410), sent from Toronto a despatch to the *New York Times*, the substance of which is reproduced in the *Bulletin* of the American Geographical Society for October. It states that Stefánsson started on his northern journey from Martin point, Alaska (about 143° W.), on March 21, with four sledges, twenty-five dogs, and six men. A supporting party with supplies of food was to accompany him for ten days, and then return. On March 25 the party was stopped by open water, but seal meat was procured, and, after sending some of the supporting party back on March 27, the leader was able to resume his advance. On April 16 the edge of the continental shelf was reached, apparently in 70° 20′ N., 140° 30′ W., or only some 30 miles from the coast, as against about 60 miles on the line of Mikkelsen and Leffingwell's ice-trip. There was here much open water. Three men—Crawford, Johansen, and McConnell—were now sent back, while Stefánsson, Ole Anderson, and Storkensen continued north with one sledge, six good dogs, two rifles, and plenty of ammunition. It was proposed to turn back after fifteen days. Stefánsson is said to have believed that wind and currents might force him to make east for Banks island, where he would live on the country till relief could reach him. Whalers, however, subsequently reached the island without seeing any trace of the explorers, and it is feared that they may have been unable to reach the island, though in view of Stefánsson's proved resourcefulness, it is thought that his party might survive for a year, should their ammunition hold out. It is reported that Stefánsson's vessel, the *Mary Sachs*, left Herschel island on August 11 with a view to establishing depôts for his use on Banks island.* As regards the drift of the *Karluk* and the subsequent adventures of her crew, some additional details are given in a despatch from Toronto communicated to the *Morning Post* of November 9 by Dr. W. S. Bruce. The drift is said to have been in a generally west direction, and to have been caused mainly by the wind, as very little movement of the water was observed. Fresh seal and bear meat was obtained during the drift, and a plentiful supply of provisions was transferred to the camp on the ice when the ship sank on January 11. Land was then in sight, and it proved to be Herald island, though at first mistaken for Wrangel island. It was in attempts to reach this, early in February, that the two missing parties were lost. A party sent in search of them, which approached Herald island and examined it with field glasses, failed to see any men on it. The rest of the crew set out for Wrangel island in two parties on February 19 and 24, and eventually reached their destination, though delayed by the necessity of cutting a road through a huge ice-rafter. The party reached Wrangel island on March 12, landing without difficulty on Icy spit, where plenty of driftwood was found, and further supplies were brought from Shipwreck camp. Captain Bartlett's journey in quest of help, and the eventual rescue of the shipwrecked men have already been referred to in the *Journal* (vol. **44**, pp. 234, 410). Mr. McKinlay, the sole survivor of the scientists on the *Karluk*, reached England in November.

Sir E. Shackleton's Expedition finally sailed south from Buenos Aires, where the leader had joined the *Endurance*, on October 27, bound for South Georgia. Before sailing, Sir Ernest communicated to the *Daily Chronicle* his final plans, which have been somewhat modified since first laid down. The principal change consists in his decision to keep the *Endurance* in the Antarctic during the winter of 1915, instead of sending her north after landing his party. This is no doubt a prudent

* In a communication to the Society (*Journal*, vol. **43**, p. 448), Mr. Stefánsson said that the *Mary Sachs* would be prepared to spend two winters in this region.

arrangement, in view of the uncertainty whether the ice conditions will permit of a sufficient advance southwards to enable the transcontinental journey to be begun during the present season. During the voyage south a portion at least of the scientific staff will be left temporarily at South Georgia, and the dogs will also be put on shore on one of the smaller units of the group. Meanwhile the crew of the *Endurance* will make an examination of the pack to the south in order to judge of the possibilities of penetrating it, returning to South Georgia to pick up the rest of the expedition and the dogs, and also to fill up finally with coal. Sir Ernest will then endeavour to push through the pack to winter quarters in about 77° 30′ S., keeping well to the east in the expectation that more open water will be met with here than further west. Should conditions prove unfavourable this season the start on the overland journey will be delayed till October, 1915. During the stay at Buenos Aires, Sir Ernest met with much courtesy from the Argentine Government, which has lent the expedition a wireless receiver, rendering it possible to regulate the chronometers by messages at stated intervals from the Argentine Station at New Year island. As regards the Ross sea supporting expedition under Lieut. McIntosh, a Reuter telegram from Sydney on November 10 announced that most of the scientific members of the expedition were then in Sydney. The *Aurora* was being overhauled for the voyage, on which it was hoped to start at the end of the month. Several young Australian scientists will accompany the party.

GENERAL.

Coral Reefs.—Prof. W. M. Davis returned on November 9 from an expedition undertaken for the study of coral reefs in the Pacific. He had visited thirty-five islands, all of which, in his view, testify strongly in favour of Darwin's theory of subsidence. The journey embraced Oahu in Hawaii, eighteen islands of the Fiji group, New Caledonia, the Loyalties, five of the New Hebrides, a long stretch of the Queensland Coast inside of the Great Barrier Reef, Rarotonga in the Cook group, and six of the Society islands.

Old Dutch Sea-books.—Among the early books of instructions to sailors, dating from the late fourteenth and early fifteenth centuries, the most important are those produced in Holland and France. Among the latter is the well-known 'Routtier' of Pierre Garcie, which formed the basis of later English works of the same kind, while the Dutch works have been brought into notice by the important memoir of Dr. Walter Behrmann, published in 1906 in the *Mitteilungen* of the Hamburg Geographical Society. The oldest type is represented by two manuscript examples bearing the simple title 'Seebuch,' both of which, preserved in the Kommerzbibliothek at Hamburg, were printed by K. Koppmann at Bremen in 1876. Two facsimile reproductions of the somewhat similar 'Leeskaarten' of Jan Jacobszoon, of 1540 and 1541 (of which the only known copies are in the Amsterdam University Library), were published at Leiden in 1885, and are in the Society's library, but until the present year nothing had been done to make generally accessible the earlier 'Kaert vander Zee' of Jan Seuerszoon, brought out in 1532, of which also a single copy, preserved in the Brussels Royal Library, is extant. The want has now been supplied by the issue of an excellent reprint at Copenhagen (G. E. C. Gads Forlag; agent in Holland, M. Nijhoff, The Hague) under the editorship of Johannes Knudsen. The text has, for convenience, been divided into chapters and paragraphs, and references are given to the corresponding sections, both of the 'Seebuch' and of Jacobszoon's 'Caerte vander Zee' of 1541. A tabulated summary of the contents of this last is also supplied, with references to the corresponding passages in the 'Seebuch' and in the work of 1532 now reproduced. A comparison of the three is thus rendered easy. In discussing the origin and relationships of these works, the editor points out that though whole passages are common to all, there are important differences both in the total content and in the arrangement. This is but natural if we consider that the sailing directions would be gradually made up by piecing together items collected by sailors during the course of their voyages and mutually exchanged, often in the form of loose leaves. The resemblances between the different types will be due merely to identity of source. A steady evolution of a standard type seems, however, to be traceable, and the material forming the basis of the later works was more extensive than that of the earlier. It may be noted that besides copies of English 'Rutters,' dating from the latter part of the sixteenth century, the Society's library possesses one of an early Danish work of the same character (Copenhagen, 1568), which seems to be of considerable rarity.

The Balboa Celebrations in 1913.—Balboa's discovery of the Pacific was celebrated by the Madrid Geographical Society at a meeting held on September 25, 1913, at which discourses on the subject were delivered by various speakers. The number of that Society's *Boletin* which contains the report of the meeting (Tomo 55, cuarto trimestre de 1913) gives also a translation of Sir Clements Markham's paper on Balboa read at this Society and published in vol. **42** of the *Journal*. A second and independent translation has also been published by the Geographical Society of Mexico. While the Madrid version is content with a prose translation of the well-known lines of Keats, quoted by Sir Clements, that printed in Mexico ventures upon a very good version in Spanish verse.

Gilchrist Studentship in Geography.—The institution by the Gilchrist trustees of a Studentship in Geography of the value of £100, to be offered annually to teachers of geography desirous of undertaking advanced work in the subject, was recorded in this *Journal* in 1912 (vol. **39**, p. 164), and the rules and conditions of the Studentship were printed in the same volume, p. 381. It is now announced that applications for the next award of the Studentship are to be sent to the Hon. Secretary, Geographical Association, 40, Broad Street, Oxford, not later than February 7, 1915. They must be accompanied by the necessary documents, as specified in paragraph 5 of the rules and conditions above referred to.

OBITUARY.

Lord Roberts.

By the death of Field-Marshal the Right Hon. Earl Roberts, V.C., K.G., K.P., O.M., G.C.B., etc., at the age of eighty-two years, the Society has lost one of its most distinguished Fellows; he had been a member of the Society for thirty-three years.

Although Lord Roberts was not often seen at the Meetings of the Geographical Society, yet he took an active interest in its work. During the time when he was Commander-in-Chief in India he was in constant communication with our then President, his old friend Sir Mountstuart Grant Duff, on matters concerned with the progress of geography, and in several cases he used his influence to further our objects and to remove, as far as was in his power, official obstacles to their fulfilment. Moreover, apart from the sympathy which he always extended to those engaged in any enterprise which demanded energy and resolution and which added to the general sum of human knowledge, he had a close practical acquaintance with that phase of geographical activity which affected military progress, and a thorough appreciation of its value. At a time when most generals regarded the work of the geographer in the military field as a harmless effort to acquire scientific information which might finally be embodied in a map for the benefit of an inquiring public, Lord Roberts was the first (if we except, perhaps, Lord Napier of Magdala and Sir Michael Biddulph) to realize the practical value of a scheme of military surveying which could give good account, not only of the country traversed by military operations, but of that which lay ahead and on either side of the actual route of an army; which could map out a field of action whilst that action was in progress, and put into the hands of the commander the detailed plan almost as soon as the action was finished. No appeal was ever made in vain to Lord Roberts for the necessary military assistance to support a reconnaissance or to safeguard a working party to a distant point of vantage; he believed that map knowledge was as essential to strategy as it might prove to be to political counsels when a campaign was over. He understood a map thoroughly, and was convinced that the mapmaker was his best intelligence officer. In that belief he maintained that accurate geographical knowledge was by no means the least of the assets secured by a successful campaign, and he strongly advocated that survey officers should form an integral part of the Headquarters Staff on the field and should hold their own proper military rank as such. But Lord Roberts' views on military efficiency and preparedness were not always popular in India any more than they were in England, and he did not succeed. The military officer employed in making the maps necessary for the conduct of a campaign on the Indian frontier when maps were non-existent still ranked as a civilian scientist. This, however, never affected the results of effectual backing by the chief of the expedition, and it is mainly to Lord Roberts that we owe the comprehensive map knowledge that we possess of the great Afghan uplands beyond the frontier hills from the Indus to Kabul and the Hindu Kush. If Lord Roberts was not often seen in the hall of the Royal Geographical Society, this was due (as he has himself told me) to the great variety of his active pursuits in life and to want of time rather than to want of interest in geography. If not an explorer himself he was keenly interested in exploration, and nothing pleased him more than to discuss the results of the latest geographical expedition.

T. H. Holdich.

CORRESPONDENCE.

The Tsang-po.

61, Melville St., Edinburgh, October 9, 1914.

Captain Bailey's stirring and withal modest account of his and Captain Morshead's enterprising dash for the unexplored section of the Tsang-po will command the admiration of all those who are interested in the problem which these two gallant officers have done so much to solve. Albeit a short section of 30 miles of the river, including the location of its confluence with the Po-Chu, still remains to be explored, its course cannot materially differ from that immediately above, viz. from Gyala to Churung Chu.

In the *Geogr. Journal* of May, 1913 (vol. **41**, p. 501), *sub* Correspondence, I showed by a tabulated longitudinal section of the Tsang-po from its source to the point of its emergence into the plains of India as the Dihong-Brahmaputra, that in the then unexplored 85 miles from Gyala downwards, where it cuts through the Himalayas, the drop by a succession of rapids would probably be at the average rate of 52 feet per mile, or 10 in 1000. This is fully borne out by the survey figures which Captain Bailey, on p. 351 of his paper, gives of the section from Pe to Gyala, Lagung, and the confluence of the Chimdru, for the actual total drop in the 139 miles works out 7072 feet, equal to an average fall of 50·9 feet per mile, or 9·6 in 1000.

By way of comparison with the Alps, the nearest analogy, though of course on a smaller scale, to the stupendous V-shaped gorges eroded by the Tsang-po between Gyala Peri and Namcha Barwa, of which Captain Bailey's beautiful photograph facing p. 356 gives a most revealing picture, will be found in the upper Rhone valley, between the Dent du Midi and the Dent des Morcles below Martigny, where the Rhone, like the Tsang-po, has cut the main mountain range at right angles, the comparative figures being as follows:

	Tsang-Po.	Rhone.
On right	Namcha Barwa, 25,445 ft.	Dent des Morcles, 9700 ft.
On left	Gyala Peri, 23,460 ft.	Dent du Midi, 10,750 ft.
Aërial distance between summits	„ 12 miles	„ „ 6 miles.
Level of river	„ 9,000 ft.	„ „ 1500 ft.
Mean vertical depth of valley	„ 13,402 ft.	„ „ 8725 ft.

The course of the upper Rhone presents another feature analogous to that of the Tsang-po in that its drop from the Rhone glacier to Martigny is 4240 feet in 80 miles, equal to 52 feet per mile or 10 in 1000, viz. almost the same average fall as that of the Tsang-po in the Himalaya section already referred to. The Tsang-po therefore does not materially differ from other rivers of an Alpine character which have cut their bed through mountain ranges at the point of least resistance. Shorn, not indeed of the beauty of its stupendous scenery, but only of the romance of its imaginary waterfalls, its course has proved to be a strictly normal one, interspersed with a series of rapids, as I, among others, ventured to predict.

Perhaps, in the sequel, Captain Bailey will be able to afford some information as to the nature of the rock-formations in the Gyala section of the river, and thus supplement his luminous paper.

There is in his expedition one important point which specially commends itself to the appreciation of linguists, namely, that his success, with his limited outfit and resources, was in no small degree due to his knowledge of the Tibetan language.

C. Du Riche Preller.

MEETINGS OF THE ROYAL GEOGRAPHICAL SOCIETY, SESSION 1914–1915.

First Meeting, November 9, 1914.—Douglas W. Freshfield, Esq., President, in the Chair.

Elections.—*Dr. Seymour Armstrong; Samuel David Bles; Arthur Bond; Captain N. P. Brooke (Leinster Regiment); Miss Susan Gearon; W. Howard*

Hazell; Victor Alexander Löwinger; James Hector McKay; James Metcalfe, M.D.; James Murray; Major Jas. E. Platt, J.P.; Harrison Parkinson Sharp; William Francis Stacey; George Alfred Tozer; Lieut. Owen Evelyn Wynne, R.E.

The paper read was:—

"The Geography of the War." By Hilaire Belloc.

Afternoon Meeting, November 19, 1914.—DOUGLAS W. FRESHFIELD, Esq., President, in the Chair.

The paper read was:—

"Submarine Slopes." By Prof. Stanley Gardiner, F.R.S.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By EDWARD HEAWOOD, M.A., *Librarian*, R.G.S.

The following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are as a rule written in full:—

A. = Academy, Academie, Akademie.
Abh. = Abhandlungen.
Ann. = Annals, Annales, Annalen.
B. = Bulletin, Bollettino, Boletim.
Col. = Colonies.
Com. = Commerce.
C.R. = Comptes Rendus.
E. = Erdkunde.
G. = Geography, Géographie, Geografia.
Gen. = Genootschap.
Ges. = Gesellschaft.
I. = Institute, Institution.
Int. = International.
Iz. = Izvestiya.
J. = Journal.
Jb. = Jahrbuch.
Jber. = Jahresbericht.
k.(k.) = kaiserlich (und königlich).
M. = Mitteilungen.
Mag. = Magazine.
Mem. (Mém.) = Memoirs, Mémoires.
Met. (mét.) = Meteorological.
P. = Proceedings.
R. = Royal.
Rev. (Riv.) = Review, Revue, Rivista.
S. = Society, Société, Selskab.
Sc. = Science(s).
Sitzb. = Sitzungsbericht.
T. = Transactions.
Ts. = Tijdschrift, Tidskrift.
V. = Verein.
Verh. = Verhandlungen.
W. = Wissenschaft, and compounds.
Z. = Zeitschrift.
Zap. = Zapiski.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half-inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

Alps. **Rey.**
Peaks and precipices. Scrambles in the Dolomites and Savoy. By Guido Rey. London: T. Fisher Unwin, [1914]. Size 10½ × 7, pp. 238. *Illustrations. Price* 10*s.* 6*d. net. Presented.*

Alps—Limnology. *Deutsche Rundschau für G.* **36** (1913–14): 356–361. **Brehm.**
Neue Ergebnisse der zoogeographischen Durchforschung unserer Alpenseen.

Austria—Salzburg—Moors. *Z. Ges. E. Berlin* (1914): 302–306. **Crammer.**
Zur deutschen Landeskunde. VI. Die Moore Salzburgs und ihre Beziehungen zur Eiszeit. By Hans Crammer.

Austria—Tirol. **Klebelsberg.**
Südtiroler geomorphologische Studien. Das mittlere Eisacktal. I. Teil. Von R. v. Klebelsberg. (Sonderabdruck aus der Zeitschrift des Ferdinandeums, III. Folge, 56 Heft.) *Chart.* Pp. 116.

Belgium. **MacDonnell.**
Belgium: Her Kings, Kingdom and People. By John de Courcy MacDonnell. London: John Long, 1914. Size 9 × 6, pp. xii. and 354. *Illustrations. Price* 15*s*.

Denmark—Jutland—Amrum. **Krause.**
Die Insel Amrum. Eine Landeskunde. Von Dr. August Krause. (Geographische Arbeiten herausgegeben von Dr. Willi Ule, 9.) Stuttgart: Strecker & Schröder, 1913. Size 8½ × 6, pp. 88.

Europe—Historical. **Waddington.**
Richard Waddington. La guerre de sept ans: histoire diplomatique et militaire. Tome V. Paris, [1914]. Size 9 × 6, pp. 444. *Maps and Plans.*

Germany—Bavaria. *Z. Ges. E. Berlin* (1914): 280-295. **Krebs and Lehmann.**
Zur Talgeschichte der Rezat-Altmühl. Von Dr. Norbert Krebs und Dr. Otto Lehmann.

Germany—Black Forest. *Z. Ges. E. Berlin* (1914): 199-209. **Braun.**
Zur deutschen Landeskunde. V. Der Schwarzwald.

Germany—Motor routes. **Hecht.**
The motor routes of Germany. By Henry J. Hecht. (Edited by Gordon Home.) London: Adam & C. Black, 1914. Size 8½ × 5½, pp. xxiv. and 456. *Map, Illustrations and Plans. Price* 5*s*.

Hungary—Lake Balaton. *G.Z.* **20** (1914): 324-333. **Lóczy.**
Die Geomorphologie der Umgebung des Balaton (Platten-) Sees. Von Prof. Dr. Ludwig von Lóczy. *Sketch-maps.*

Iceland. *Z. Ges. E. Berlin* (1914): 169-199. **Trautz.**
Die Kverkfjöll um die Kverkhnúkaranar im Hochland von Island. Von Max Trautz.

Iceland—Volcanoes. *Z. Ges. E. Berlin* (1914): 364-393. **Spethmann.**
Die Schildvulkane des östlichen Inner-Island. Von Dr. Hans Spethmann. *Sketch-map.*

Italy—Lombardy—Early Map. **Baratta.**
Riv. G. Italiana **20** (1913): 449-459, 579-593.
La carta della Lombardia di Giovanni Pisato (1440). By Mario Baratta. *Sketch-map.*

Italy—Piedmont—Rainfall. *Riv. G. Italiana* **21** (1914): 64-79. **Anfossi.**
Le precipitazioni nella valle del Sangone. By G. Anfossi. *Illustrations.*

Italy—Tides. *Riv. G. Italiana* **21** (1914): 80-91. **Loperfido.**
La Commissione Mareografica e il servizio mareografico in Italia. By Antonio Loperfido.

Italy—Vesuvius. *B.R.S.G. (Rome) Ser. V.* **3** (1914): 753-805. **Malladra.**
Nel cratere del Vesuvio. By Alessandro Malladra. *Illustrations.*

Mediterranean. **Reynolds-Ball.**
Mediterranean Winter Resorts. A complete and practical handbook to the principal health and pleasure resorts on the shores of the Mediterranean. By Eustace Reynolds-Ball. Vol. 1. South Europe. 7th Edition. London: Kegan Paul, 1914. Size 7 × 4, pp. 636. *Map. Price 5s. net. Presented by the Publishers.*

Russia—Caspian. *Vierteljahrs. Naturforsch. Ges. Zürich* **58** (1913): 298-309. **Staub.**
Tektonische Beobachtungen am Westufer des Kaspischen Meeres. Von Walther Staub. *Map and Illustrations.*

Russia—Finland—Hydrography. **Witting.**
Jahrbuch 1911, enthaltend Hydrographische Beobachtungen in den Finland umgebenden Meeren. Von Dr. Rolf Witting. (Finländische Hydrographisch-

Biologische Untersuchungen, No. 10.) Helsingfors, 1912. Size 12½ × 10, pp. 131. *Illustrations.*

Russia—Railways. **Stavenhagen.**

Russlands Eisenbahnwesen. Von W. Stavenhagen. (Sonderabdruck aus den "Mitteilungen über Gegenstände des Artillerie- und Geniewesens," Jahrgang 1913, Neuntes Heft. Pp. 729–748.)

Spain. **Calvert.**

Spain. By Albert F. Calvert. London: J. M. Dent, 1911. Size 12 × 9, pp. xx. and 896. *Map and Illustrations. Presented by the Author.*

Switzerland—Bernina. **Staub.**

Vierteljahrs. Naturforsch. Ges. Zürich **58** (1913): 329–370.

Zur Tektonik des Berninagebirges. Von R. Staub. *Maps.*

Switzerland—Geology. **Heim.**

Beiträge Geolog. Karte der Schweiz, N.F. **30** (1913): iv., 273–368, xvi.

Monografie der Churfirsten-Mattstock-Gruppe. Von Arnold Heim. Text. Zweiter Teil. Stratigraphie der Mittleren Kreide. Atlas. Erster Teil. Tafeln I bis XVI. *Maps and Illustrations.*

Switzerland—Upper Rhine basin. **Roder.**

Niederschlag und Abfluss im bündnerischen Rheingebiet während der Jahre 1894–1909. Von Ernst Roder. (Eidg. Departement des Innern. Mitteilungen der Abteilung für Landeshydrographie, Nr. 5.) Bern: Rösch & Schatzmann, 1914. Size 8½ × 6, pp. 160. *Maps and Charts. Price 4 fr.*

United Kingdom—Flintshire. **Edwards.**

Cambridge County Geographies (edited by Dr. F. H. H. Guillemard). Flintshire. By J. M. Edwards. Cambridge: University Press, 1914. Size 7½ × 5, pp. xii. and 172. *Maps and Diagrams. Price 1s. 6d. Presented.*

United Kingdom—Lincolnshire. **Rawnsley.**

Highway and byways in Lincolnshire. By Willingham Franklin Rawnsley, with illustrations by Frederick L. Griggs. London: Macmillan & Co., 1914. Size 8 × 5½, pp. xviii. and 520. *Illustrations. Price 5s. net. Presented.*

United Kingdom—Mendips. **Balch.**

Wookey Hole. Its caves and cave dwellers. By Herbert E. Balch, with an introduction by Prof. Boyd Dawkins. Oxford: University Press, 1914. Size 12½ × 10, pp. xiv. and 268. *Diagrams, Sections, and Illustrations. Price 25s. net.*

United Kingdom—Motor routes. **Darlington.**

Motor routes through England and Wales and the South of Scotland. Llangollen: Ralph Darlington & Co., [1914]. Size 6½ × 4½, pp. 96. *Maps and Illustrations. Price 1s. Presented.*

United Kingdom—Notts. **Lamplugh and others.**

Memoirs of the Geological Survey. England and Wales. The water supply of Nottinghamshire from underground sources. By G. W. Lamplugh and B. Smith, with a chapter on the rainfall by Dr. H. R. Mill. London, 1914. Size 9½ × 6, pp. 174. *Maps and Sections.*

United Kingdom—Scotland. **Pringle.**

Cambridge County Geographies (Scotland, edited by W. Murison). Peebles and Selkirk. By George C. Pringle. Cambridge: University Press, 1914. Size 7½ × 5, pp. x. and 150. *Maps, Diagrams, and Illustrations. Price 1s. 6d. Presented.*

United Kingdom—Scotland—Arran. *Scottish G. Mag.* **30** (1914): 393–404. **Mort.**

The sculpture of North Arran. By Dr. Frederick Mort. *Sketch-map, Diagrams, and Illustrations.*

United Kingdom—Scotland—Eigg. *Geol. Mag.* VI. 1 (1914): 296–305. **Bailey.**

The Sgurr of Eigg. By E. B. Bailey. *Illustrations and Sketch-map.*

United Kingdom—S.E. England. **Eichrodt.**

Der Weald und die Downs Südostenglands. Eine siedlungs- und wirtschaftsgeographische Studie. Von Dr. Ilse Eichrodt. Heidelburg, 1914. Size 9 × 5½, pp. 88. *Presented by the Author.*

United Kingdom—Suffolk. **Boswell.**

On the occurrence of the North Sea drift (Lower glacial), and certain other brick-earths, in Suffolk. By P. G. H. Boswell. (From *Proc. Geologists' Assoc.*, vol. 25.) Plumstead (London), 1914. Size 8½ × 5½, pp. 121–154. *Sketch-map, Sections, and Illustrations.*

United Kingdom—Survey. **Ordnance Survey.**

Report of the progress of the Ordnance Survey to the 31st March, 1914. London, 1913. 9½ × 6, pp. 20. *Index-charts.*

United Kingdom—Yorkshire. *J. Manchester G.S.* 29 (1913): 73–94. **Sheppard.**

The geography of East Yorkshire. By T. Sheppard. *Sketch-map and Illustration.*

ASIA.

Central Asia—Pamirs. *Z. Ges. E. Berlin* (1914): 355–364. **Von Ficker.**

Die Pamirexpedition des Deutschen-Oesterreichischen Alpenvereins 1913. Von Dr. H. v. Ficker.

The expedition led by Mr. Rickmers (*Journal*, vol. 42, p. 570; 43, p. 182).

Central Asia—Tian Shan. **Merzbacher.**

Ueber das Alter der Gesteine der Angaraserie in den Vorketten der Bogdo Ola Gruppe. By Gottfried Merzbacher. Moscow, 1913. Size 10 × 8, pp. 15. *Illustrations.* [Russian *résumé*.]

China—Kiang-su. *J. North China Branch R. Asiatic S.* 45 (1914): 46–57. **Edgar.**

The Great Weal; or, a Christmas Journey to the Huangho mouth. By Rev. J. Huston Edgar. *Maps.*

Refers to the raised silted tract at the old mouth of the Hwang-ho.

China and Japan. **Von Richthofen.**

Ferdinand Von Richthofen; 1. Chinas Binnenverkehr. Vortrag vor dem Deutschen Geographentag in Breslau. 2. Aus den Japan-Tagebüchern. (Mitteilungen des Ferdinand Von Richthofen-Tages 1912.) Berlin: Dietrich Reimer, 1912. Size 9½ × 6½, pp. 195.

China and Tibet. *J. North China Branch R. Asiatic S.* 45 (1914): 32–45. **Edgar.**

Through the Land of Deep Corrosions. By Rev. J. Huston Edgar. *Map.*

On a journey from Batang to Menkong, across the great river-valleys of the tract between China and India.

Eastern Asia—Historical. **Kergariou and Joinville.**

Société de l'Histoire des Colonies Françaises. La mission de la Cybèle en Extrême-Orient, 1817–1818. Journal de voyage du Capitaine A. de Kergariou. Publié et annoté par Pierre de Joinville. Paris: E. Champion, 1914. Size 9½ × 6, pp. xxii. and 248. *Sketch-map.*

India—History. **Smith.**

The early history of India, from 600 B.C. to the Muhammadan conquest. By Vincent A. Smith. 3rd edit., revised and enlarged. Oxford: Clarendon Press, 1914. Size 9½ × 6, pp. x. and 512. *Maps, Plans, and Illustrations. Price 14s. net.*

Manchuria—Moukden. **Christie.**

Thirty years in Moukden, 1883–1913. Being the experiences and recollections of Dugald Christie. Edited by his wife. London: Constable & Co., 1914. Size 9 × 6, pp. xiv. and 304. *Sketch-map, Plan, and Illustrations. Price 8s. 6d. net.*

Russia—Caucasus. **Distel.**

Ergebnisse einer Studienreise in den zentralen Kaukasus. Von L. Distel. (Abh. des Hamburgischen Kolonialinstituts, Bd. 22, 1914.) Hamburg, 1914. Size 11 × 7½, pp. viii. and 96. *Map and Illustrations. Presented.*

Russia—Siberia. **Nansen.**

Through Siberia, the land of the future. By Dr. Fridtjof Nansen. London: William Heinemann, 1914. Size 10 × 7, pp. xvi. and 476. *Maps and Illustrations. Price 15s. net. Presented.*

Russian Turkestan—Hydrography. *Z. Ges. E. Berlin* (1914): 341–355. **Woeikof.**

Die Gewässer Russisch-Turkestans und die Zukunft der Bodenkultur des Landes.

Tibet—Meteorology. *J. North China Branch R. Asiatic S.* 45 (1914): 57–64. **Edgar.**
Notes on Temperatures in High Altitudes on the Thibetan Border. By Rev. J. Huston Edgar.

Turkey—Railways. **Schmidt.**
Das Eisenbahnwesen in der asiatischen Turkei. Von Dr. Hermann Schmidt. Berlin: F. Siemenroth, 1914. Size $9\frac{1}{2} \times 6$, pp. 158. *Map. Price* 5*s.*

AFRICA.

British East Africa. **Bennet.**
Shots and snapshots in British East Africa. By Dr. E. Bennet. London: Longmans, Green & Co., 1914. Size $9\frac{1}{2} \times 6$, pp. xii. and 312. *Map and Illustrations. Price* 12*s.* 6*d. net. Presented.*

British East Africa. **Jack.**
On the Congo Frontier. Exploration and Sport. By Major E. M. Jack. London: T. Fisher Unwin, 1914. Size 9×6, pp. 302. *Map and Illustrations. Price* 10*s.* 6*d. net. Presented.*

French Chad Territories. **Gaillard and Poutrin.**
Étude anthropologique des populations des Régions du Tchad et du Kanem. Par R. Gaillard et L. Poutrin. (Extrait des 'Documents Scientifiques de la Mission Tilho,' Tome III.) Paris, 1914. Size 11×7, pp. 112. *Map and Illustrations. Price* 3*s.* 6*d. Presented.*

Madeira. **Power.**
Tourist's guide to the Island of Madeira. Compiled by C. A. le Power. London: G. Philip, 1914. Size $7\frac{1}{2} \times 5$, pp. 72. *Map and Illustrations. Price* 3*s.* 6*d. net. Presented.*

Morocco. *L'Afrique Française* 24 (1914): 103–106. **Bernard.**
Une carte par renseignements de la région des Tsoul et des Branes. Par Capitaine Bernard. *Sketch-map.*
The district lies north of Taza and west of the middle Muluya.

Morocco. *L'Afrique Française* 24 (1914): 109–125. **Delbrel and Segonzac.**
Taza et la troué de Taza d'après les anciens voyageurs. Par V. M. G. Delbrel et le marquis de Segonzac. *Map and Illustrations.*
The map is on the scale of 1 : 200,000.

Nigeria—Ethnology. **Thomas.**
Anthropological Report on the Ibo-speaking peoples of Nigeria. By Northcote W. Thomas. Parts 4–6. London: Harrison & Sons, 1914. Size $9 \times 5\frac{1}{2}$, pp. (Part 4) 208; (Part 5) x. and 184; (Part 6) viii. and 116. *Sketch-map and Illustrations. Presented by the Government of Southern Nigeria.*

Nigeria—Language. **Thomas.**
Specimens of Languages from Southern Nigeria. By Northcote W. Thomas. London: Harrison & Sons, 1914. Size 11×7, pp. 144. *Sketch-maps. Presented by the Crown Agents for the Colonies.*

Sahara—Borku. **Largeau.**
Renseignements Col. (*L'Afrique Française*) 6 (1914): 201–216.
La Colonne d'Occupation du Borkou. By Colonel Largeau. *Sketch-map and Illustrations.*

Togoland. **Gehrts.**
A camera actress in the wilds of Togoland. By Miss M. Gehrts, with an introduction by Major H. Schomburgk. London: Seeley, Service & Co., 1915. Size 9×6, pp. xx. and 316. *Sketch-map and Illustrations. Price* 12*s.* 6*d. net.*

NORTH AMERICA.

Canada—New Brunswick. **Goldthwait.**
Geol. Survey (Canada), Museum B. 2 (1914); 45–67.
Supposed Evidence of Subsidence of the Coast of New Brunswick within Modern Time. By J. W. Goldthwait. *Sketch-maps.*

United States—Illinois—Chicago. **Cox and Armington.**
The Geographic Society of Chicago. Bulletin No. 4. The Weather and Climate

of Chicago. By Henry J. Cox and John H. Armington. Chicago: University of Chicago Press [Cambridge: University Press], 1914. Size 10 × 6½. *Sketch-maps and Diagrams. Price 12s. net. Presented by the Cambridge University Press.*

United States—Missouri. *J. Geology* **22** (1914): 498–500. **Dake.**
Stream Piracy and Natural Bridge in the Loess of South-East Missouri. By C. L. Dake. *Illustration.*

CENTRAL AND SOUTH AMERICA.

Panama. **Bullard.**
Panama. The Canal, the Country, and the People. By Arthur Bullard. (Albert Edwards.) Revised edition with additional chapters. New York: The Macmillan Company, 1914. Size 8 × 5½, pp. xiv. and 602. *Illustrations. Price 8s. 6d. net. Presented.*

AUSTRALASIA AND PACIFIC ISLANDS.

Australia. **Knibbs.**
The Commonwealth of Australia. Federal handbook prepared in connection with the eighty-fourth meeting of the British Association for the Advancement of Science held in Australia, August, 1914. Compiled under the authority of the Federal Council of the Association. Edited by G. H. Knibbs. Melbourne, 1914. Size 9½ × 6, pp. 598. *Maps and Illustrations.*

Australia—Rainfall. *Scottish G. Mag.* 30 (1914): 527–531. **Wallis.**
The Rainfall Régime of Australia. By B. C. Wallis. *Sketch-maps.*

Caroline Islands—Yap. *Deutsches Kolonialblatt* **25** (1914): 561–577. **Külz.**
Deutsch-Neuguinea. Zur Pathologie und Demographie der Insel Jap, unter besonderer Berücksichtigung ihres Bevölkerungsrückganges. Von Prof. Dr. Külz.

New Guinea—German. *Z. Ges. E. Berlin* (1914): 254–277. **Behrmann.**
Geographische Ergebnisse der Kaiserin-Augustafluss-Expedition. Von Dr. Walter Behrmann. *Sketch-map.*

New Guinea—German. *Z. Ges. E. Berlin* (1914): 249–253. **Stollé.**
Ueberblick über den Verlauf der Kaiserin-Augustafluss Expedition. Von Bezirksamtmann Stollé.

POLAR REGIONS.

Antarctic—German Expedition. *Z. Ges. E. Berlin* (1914): 118–129. **Brennecke.**
Deutsche Antarktische Expedition. Die ozeanographischer Arbeiten im Weddell-Meer. Von Dr. W. Brennecke. *Illustrations.*

Antarctic—Meteorology. *Met. Z.* **31** (1914): 120–127. **Barkow.**
Vorläufiger Bericht über die meteorologischen Beobachtungen der Deutschen Antarktischen Expedition, 1911–12. Von E. Barkow. *Illustrations.*

Antarctic—Scott Expedition. **Priestley.**
Antarctic Adventure. Scott's Northern Party. By Raymond E. Priestley. London: Fisher Unwin, 1914. Size 9 × 6, pp. 382. *Illustrations. Price 15s. net. Presented.*

Antarctic—Swedish Expedition. **Carlson.**
Süsswasseralgen aus der Antarktis, Südgeorgien und den Falkland Inseln. Von G. W. F. Carlson. (Wissenschaftliche Ergebnisse der Schwedischen Südpolar-Expedition 1901–1903 unter Leitung von Dr. Otto Nordenskjöld, Band IV. Lieferung 14.) Stockholm, 1913. Size 11 × 8½, pp. 94. *Illustrations.*

Arctic—Nomadic Life. **Wiklund.**
Frageschema für die Erforschung des Renntiernomadismus. Von K. B. Wiklund. (Extrait du *Journal de la Société Finno-Ougrienne.*) Helsingfors, 1913. Size 10 × 6½, pp. 18.

MATHEMATICAL GEOGRAPHY.

Navigation. **Raper.**
The practice of navigation and nautical astronomy. By Lieut. Henry Raper.

12th edit. Revised and enlarged. London: J. D. Potter, 1914. Size 10 × 6, pp. xxvi. and 934. *Diagrams. Presented.*

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Earth-movements. **Galitzin.**
B.A. Imp. Sc. St. Pétersbourg, VI. Série, **14** (1911): 983–1007.

Beobachtungen über die Vertikalkomponente der Bodenbewegung. Von B. Galitzin. *Illustrations.*

Geomorphology—Sand-dunes. **Obrucheff.**

Die Haufensande, als besonderer Typus der Sandanhäufungen. By V. A. Obrucheff. *Illustrations.* (Separatabdruck aus der 'Festschrift für D. N. Anutschin.') Moscow, 1913. Size 10 × 8, pp. 30. [In Russian; German *résumé.*]

Geomorphology—Valleys. *J.G.* **22** (1914): 469–497. **Rich.**

Certain types of stream valleys and their Meaning. By John Lyon Rich. *Illustrations.*

Will be noticed in the Monthly Record.

Oceanography—Mediterranean. *B.I. Océanographique,* No. 289 (1914): pp. 19. ———

Commission Internationale pour l'exploration scientifique de la Mer Méditerranée. Report on the second meeting, February, 1914.

Oceanography—Mediterranean. **Chevallier.**

Etude bathylithologique des Côtes de la Mediterranée d'Antibes à Menton. Par M. A. Chevallier. (*Annales de l'Institut. Océanographique,* Tome VII. Fasc 1.) Paris: Masson et Cie., 1914. Size 13 × 10, pp. 35. *Maps and Illustrations.*

Oceanography—North Atlantic. **Board of Trade.**

Ice observation, meteorology, and oceanography in the North Atlantic Ocean. Report on the work carried out by the S.S. *Scotia,* 1913. London, 1914. Size 13 × 8½, pp. 142. *Charts and Diagrams. Presented by the Board of Trade.*

Oceanography—Tides. **R. Magistrato alle Acque.**

R. Magistrato alle Acque. Ufficio Idrografico. Pubblicazione N. 30. Norme ed istruzioni per il servizio mareografico. Part 1ª—observazione delle maree. Venice, 1911. Size 10½ × 7, pp. 46. *Illustrations.*

Physical Geography. *Scottish G. Mag.* **30** (1914): 237–542. **Falconer.**

The Progress of Physical Geography. By J. D. Falconer.

River transport. **Gilbert.**

The transportation of débris by running water. By Grove Karl Gilbert. (Department of the Interior, U.S. Geological Survey, Professional Paper 86.) *Illustrations.*

Seismology. *Petermanns M.* **60** (1914): 124–130; 184–189. **Rudolph and Szirtes.**

Zur Erklärung der geographischen Verteilung von Grossbeben. Von Dr. Emil Rudolph und Dr. Siegmund Szirtes.

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

Economic—Agriculture. **Willis.**

Agriculture in the Tropics. An elementary treatise. By Dr. J. C. Willis. 2nd edit., revised. Cambridge: University Press, 1914. Size 9 × 5½, pp. xvi. and 224. *Illustrations. Price* 9*s. net.*

Economic—Cotton. *G.Z.* **20** (1914): 241–257. **Oppel.**

Der Anbau der Baumvolle in Abhängigkeit von Klima und Boden. Von Prof. Dr. A. Oppel.

History of Geodesy. **Wagner.**

Die literarischen Schicksale der Fernelschen Erdmessung von 1527. Von Hermann Wagner. (Aus den Nachrichten der K. Gesellschaft der Wissenschaften zu Göttingen, Philologisch-historische Klasse, 1913.) Size 9½ × 6½, pp. 223–251.

Mountain sickness. *Met. Z.* **31** (1914): 257–265. **Durig.**

Die Bergkrankeit. Von A. Durig.

Political—Anglo-Saxons. **Kennedy.**
The Pan-Angles. A consideration of the federation of the seven English-speaking nations. By Sinclair Kennedy. London: Longmans, 1914. Size $9\frac{1}{2} \times 6$, pp. ix. and 244. *Map. Price 7s. 6d. net. Presented by the Publishers.*

States and River-basins. **Sieger.**
Deutsche Rundschau G. **36** (1913–14): 289–298, 337–346.
Staatsgrenzen und Stromgebiete. Von Robert Sieger.

Discusses the influence of river-systems in determining the boundaries of states.

Town sites. *Scottish G. Mag.* **30** (1914): 505–518. **Chisholm.**
The Situation of Towns as a subject of Teaching in Secondary Schools. By George G. Chisholm. *Maps.*

GENERAL.

Bibliography. **Royal Society.**
Catalogue of scientific papers. Fourth Series (1884–1900). Compiled by the Royal Society of London. Vol. 13. A–B. Cambridge: University Press, 1914. Size $11 \times 8\frac{1}{2}$, pp. xcviii. and 952. *Price £2 10s. net.*

This issue will run to nine volumes and will complete the catalogue to the end of the nineteenth century, after which its place is supplied by the International Catalogue of Scientific Literature.

Descriptive. **Mitton.**
Round the wonderful World. By G. E. Mitton. London: T. C. & E. C. Jack, 1914. Size $9\frac{1}{2} \times 6\frac{1}{2}$, pp. vi. and 698. *Illustrations. Price 7s. 6d. net. Presented.*

Popular descriptions of countries visited in a supposed journey round the world.

Orthography. *Cairo Scientific J.* **8** (1914): 152–155. **Mackintosh.**
Arabic Transliteration and Orthography on Maps. By C. A. G. Mackintosh.
See note in the Monthly Record, *ante*, p. 589.

Statistics. **Webersik.**
Geographisch-statistisches Welt-Lexikon. Nach neuesten Daten herausgegeben von Gottlieb Webersik. Vienna, 1908. Size $10\frac{1}{2} \times 7$, pp. 8 and 960. *Presented by the Author.*

NEW MAPS.

By E. A. REEVES, *Map Curator*, R.G.S.

EUROPE.

British Isles—England and Wales. **Ordnance Survey.**
Sheets published by the Director-General of the Ordnance Survey, from October 1 to 31, 1914.

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Berkshire, 5 S.E., 6 S.W., 7 S.W., 8 N.W., 10 N.W., 29 S.E., 37 N.W. **Carnarvonshire** (det.) 4 S.W. **Denbighshire,** 4 S.W., 5 S.E., 8 N.W., 8 S.W., 9 N.W., 9 S.E., 13 N.E., 13 S.W., 15 S.W., 24 S.W., 24 S.E., 25 N.E., 25 S.E., 26 N.E., 26 S.W., 27 N.E., 29 S.E., 30 N.E., 35 S.W., 38 S.E., 39 S.E., 40 N.E., 40 S.E., 41 N.E., 45 N.E., 46 N.W. **Flintshire,** 1 S.E., 3 S.E., 4 S.E., 5 S.W., 8 N.W., 8 S.E., 9 N.W., 11 S.W., 13 N.E., 13 S.W., 17 N.W., 18 N.E., 20 S.E., 23 N.W., 24 N.E., 25 S.E., 27 N.W. **Lancashire,** 22 S.W., 27 N.E., 39 N.E., 40 N.E., 47 S.W., 48 S.W., 49 N.W. **Oxfordshire,** 38 S.E., 44 N.W., 45 N.W., 56 S.E. **Surrey,** 21 N.W. **Yorkshire,** 32 N.W., 37 N.W., 43 S.E., 47 N.W., 51 N.E., 52 S.E., 53 N.W., 58 N.W., 59 N.E., 60 S.W., 61 N.E., 62 N.E., 67 S.E., 70 S.E., 82 N.E., 85 S.W.

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Anglesey, **19**-3, 11, 12, 15. **Carnarvonshire**, **6**-11, 12, 15, 16, **11**-11, 16, **16**-5, 6, 7, 8, 10, 12, **22**-4, 7, 11, 14, 15. **Derbyshire**, **44**-3, 4, 8, 12, 16, **45**-5, 6, 11, **50**-1, 2. **Durham**, **23**-4, 8, **53**-3, 4, 7, **54**-1, 6. **Leicestershire**, **37**-7, 10, 16. **London**, **2**-9. **Middlesex**, **12**-9, **15**-11, 16, **20**-6, **24**-4, **25**-1, **24**-(2 and 6). *Price* 1s. 6*d*. **Somersetshire**, **70**-3, 4, 7, 8, 11, 15, **71**-2, 10. **Staffordshire**, **63**-1, 2, 3, 5, 7, 8, **64**-5, 8, 9, **69**-1, 5, 6. **Surrey**, **10**-7, 8, 12, 15, **11**-9, 13, **17**-3, 5, 6, 9, 12, 13, 14, **18**-5, **24**-4, 8, 11, 12, **25**-5, 16, **33**-3, 4, 5, 8, 9, 11, 15, **34**-5, **40**-4, 8, **41**-1, 10. **Warwickshire**, **4**-8, 9, **8**-5, 6, **11**-14, **44**-2, 3, 4. **Westmorland**, **33**-2, 4, 6, 7, 10, 13, 15, **34**-1, 2, 3, **36**-1, 9, 11, **38**-3, 7, 11, 15, **39**-5, 8, 12, 16, **40**-13, **43**-5, **44**-1, 9. Sheet 35-12. *Price* 1s. 6*d*. **Yorkshire**, **4**-14, **7**-12, **12**-1, 7, 10, **13**-11, **17**-11, **18**-2, 3, 10, 14, **26**-1, **27**-3, **28**-11, 16, **42**-6, 8.

London Agents: E. Stanford, Ltd.; Sifton, Praed, & Co.

British Isles—Scotland. **Bacon.**

Bacon's Excelsior Map of Scotland (contour edition). Scale 1:316, 800 or 1 inch to 5 stat. miles. 4 sheets each 32 by 24 inches. London: G. W. Bacon & Co., Ltd., [1914]. *Price, mounted on rollers,* 16*s. Presented by the Publishers.*

One of a series of school wall maps of which several have already appeared. It is bold in style, with names of only most important places and physical features. Land relief is shown by tints of green and brown at the following intervals in feet: 0-250, 250-500, 500-1000, 1000-2000, and above 2000. Depths of the surrounding seas are given in feet in tints of blue at intervals of 0-60, 60-180, 180-300, and below 300. Railways are shown in red.

Europe. **Bacon.**

Contour War Map: Paris to Berlin. Scale 1:1,200,000 or 1 inch to 18·9 stat. miles. Size 28 by 33 inches. London: G. W. Bacon & Co. Ltd., 1914. *Price* 1*s. Presented by the Publishers.*

Superimposed on a map with hills somewhat crudely drawn in black vertical hachures, tints of green and reddish-brown are given to show relief on the layer system, at intervals in metres of 0-100, 100-300, 300-500, and above 500. A dark tint of bluish-green indicates land below sea-level. The depth of the sea below 50 metres is indicated by being tinted a dark blue. The map is to a great extent unnecessarily confused and overcrowded with small names of insignificant places.

Europe. **Darbishire.**

Central Europe. Scale 1:1,000,000 or 1 inch to 15·78 stat. miles. Drawn by B. V. Darbishire, M.A. Western Sheet, 60 by 60 inches. *Price, mounted to fold,* 10*s.* 6*d. net.* Eastern Sheet, 40 by 60 inches. *Price, mounted to fold,* 6*s.* 6*d. net.* Oxford: The Clarendon Press; London: Humphrey Milford, M.A., 1914. *Presented by the Publishers.*

A diagrammatic map issued in two parts, eastern and western, which are sold separately, but are so planned that they can be hung as one wall map. Outline and names are in black, and hills are roughly indicated by brown shading. Railways are shown to some extent, but the important lines connecting the valley of the Rhine at Cologne, Coblenz, and Mainz with north-east France have been omitted, or very incompletely laid down.

Europe. **Lloyd.**

Sketch-map of the Seat of War, 1914. By John Lloyd. Scale 1:2,851, 200 or 1 inch to 45 stat. miles. Size 11 by 15 inches. London: Edward Stanford, Ltd., 1914. *Prices* 1*s. and* 1*s.* 6*d. Presented by John Lloyd, Esq.*

Europe. **E. Stanford.**

The Seat of War in Eastern Europe. Stanford's War Maps, No. 8. Scale 1;1,140,000 or 1 inch to 18 stat. miles. Size 40 by 27 inches. London: Edward Stanford, Ltd., 1914. *Price* 5*s. Presented by the Publishers.*

Norway. **Norges Geografiske Opmaaling.**

Topografisk Kart over Kongeriket Norge. Scale 1:100,000 or 1 inch to 1·6 stat. mile. Sheet M 8, Harstad, 1912. Size 16 by 17 inches. Landgeneralkart over Norge. Scale 1:250,000 or 1 inch to 3·9 stat. miles. Sheet xxvi., Vega, 1914. Size 19 by 24 inches. Christiania: Norges Geografiske Opmaaling. *Presented by the Director of the Norwegian Geographical Survey.*

A comparison of these coloured sheets of the Government survey of Norway with those previously published in black and white only will furnish further striking evidence of the great advantage of the judicious introduction of colour in topographical maps. Not only are the names more easily legible, but by a system, such as that here adopted with very satisfactory result, the general relief is much more effectively brought out. The system consists of yellowish-brown contours (at intervals of 30 metres on the 1 : 100,000 and 50 metres on the 250,000 scale) combined with a special adaptation of "spectral" tints, which give a graphic effect to the relief, ranging from bluish-greens and greys for the lowlands and valleys, through yellows and yellowish-browns to reddish-brown for the tops of ranges and hills. Light is supposed to fall from the east or north-east, and the opposite sides of the ranges are shaded so as to further accentuate the relief, which it certainly does with some advantage, although in parts this shading, by being unnecessarily dark, tends to obliterate the contours. The tints are light and delicate, blend well together, and merge gradually one into the other without any objectionable hard line of division or abrupt contrast between them which is so frequently the case with maps on the so-called "layer" system. Heights of definite points are as usual given in figures, and these as well as place-names are in black. Rivers and lakes are in blue, but no attempt has been made to show the depths of the surrounding sea by varying tints, although numerous soundings appear. The 1 : 100,000 sheet is one of a series intended specially for the use of tourists. Many experiments have been made during recent years with the introduction of colour in cartography, and although perhaps up to the present time no entirely satisfactory system has been devised, that here adopted, with certain modifications, seems after all the most satisfactory. In a general way much the same system of colouring has been followed in the new 1-inch Ordnance Survey, an advance copy of the Killarney sheet of which was noticed in the *Geographical Journal* for October, 1913.

ASIA.

India. — **Surveyor-General of India.**

Carte Internationale des Monde au Millionième. (1 inch to 15·78 stat. miles.) Sheet F 18 Bombay. Calcutta: Survey of India, 1914. *Presented by the Surveyor-General of India.*

This [illegible] will be specially noticed.

AFRICA.

Africa. — **Geographical Section, General Staff.**

Africa. Scale 1 : 1,000,000 or 1 inch to 15·78 stat. miles. Sheet (Provisional) North B-36 (and part of North A-36), Mongalla. Compiled in the Geographical Section, General Staff, from the Sudan 1 : 250,000 sheets, Map of the Abyssinian Boundary Commission 1908, 1 : 500,000, and from Captain H. H. Kelly's Sudan-Uganda Boundary Survey, 1913. London Agents: E. Stanford, Ltd.; Sifton, Praed, & Co.; T. Fisher Unwin. *Price 2s. net.*

Egypt. — **Egyptian Survey Dept.**

Topographical Map of Egypt. Scale 1 : 10,000 or 6·3 inches to 1 stat. mile. Sheets: N.E. 16–15, 17–14, 17–15, 17–16, 18–15, 18–16, 18–17, 18–18, 19–14, 19–17, 19–18, 19–19, 19–20, 20–12, 20–14, 20–15, 20–16, 20–17, 20–19, 20–21, 21–13, 21–14, 21–15, 22–13, 22–14, 22–15, 22–16, 23–13, Mudiria Sharqia; N.W. 9–4, 10–3, 10–4, 11–4, Mudiria Beheira-Menufia. Giza: Survey Department, 1914. *Presented by the Director-General, Egyptian Survey Department.*

Morocco. — **Bureau Topographique du Maroc Occidental.**

Maroc. Carte dressée et publiée par le Bureau Topographique du Maroc Occidental. Scale 1 : 1,000,000 or 1 inch to 15·78 stat. miles. 4 sheets, each 17 by 22 inches. Casablanca, 1914.

Shows relief on the colour layer system with contour intervals, in metres, as follows: 0–300, 300–1000, 1000–2000, 2000–3000, 3000–3500, and above 3500. The tints are yellow and reddish-brown, with all high land above 3500 metres left white. Many parts of Morocco are still very imperfectly mapped, so that the contours here laid down can only be approximate; but doubtless the map gives a fair general idea of the relief. In some parts the registration of the colours is very imperfect, but this is doubtless owing to the fact that the map has not been produced under conditions favourable to excellency of style.

AMERICA.

Canada. — **Dept. of the Interior, Ottawa.**

Sectional Map of Canada. Scale 1 : 190,080 or 1 inch to 3 stat. miles. Sheets: 318, Shell River, Saskatchewan, 6th edit., June 1, 1914; 416, La Biche, Alberta, 4th edit., June 1, 1914; 465, Pelican, Alberta, 2nd edit., May 1, 1914; 513, Heart River, 2nd edit., May 1, 1914; 515. Wabiskaw, Alberta, 1st edit., July 1, 1914; 563, Notikewin, Alberta, 1st edit., June 1, 1914; 566, McKay, Alberta, 1st edit., July 1, 1914; 663, Mustus, Alberta, 1st edit., June 1, 1914; 664, Mikkwa, Alberta, 1st edit., July 1, 1914. Size 18 by 30 inches. Ottawa: Department of the Interior, Topographical Surveys Branch, 1914. *Presented by the Department of the Interior, Railway Lands Branch, Ottawa.*

United States. **U.S. Geological Survey.**

United States. Scale 1:2,500,000 or 1 inch to 39·4 stat. miles. 9 sheets each 16 by 26 inches. Washington: Department of the Interior, U.S. Geological Survey, 1913. *Presented by the Director of the United States Geological Survey.*

This is a new edition.

WORLD.

World. **Bacon.**

The Map and its Story: a physical atlas. London: G. W. Bacon & Co., Ltd., 1914. *Price* 1s. *Presented by the Publishers.*

A cheap general school atlas of forty-four coloured maps illustrating relief, vegetation, rainfall and winds, isotherms and commercial conditions of the world. Special maps are given of the British Isles. The selection of the projections for the maps has received considerable attention. Accompanying each map will be found descriptive text on the subject dealt with in the map.

CHARTS.

Atlantic, North. **U.S. Hydrographic Office.**

Pilot chart of the North Atlantic Ocean, October, 1914. Washington: U.S. Hydrographic Office, 1914. *Presented by the U.S. Hydrographic Office.*

Atlantic, North, and Mediterranean. **Meteorological Office.**

Monthly Meteorological charts of the North Atlantic and Mediterranean, November, 1914. London: Meteorological Office, 1914. *Price 6d. each. Presented by the Meteorological Office.*

Indian Ocean. **Meteorological Office.**

Monthly Meteorological charts of the Indian Ocean, November, 1914. London: Meteorological Office, 1914. *Price 6d. each. Presented by the Meteorological Office.*

PHOTOGRAPHS.

East Africa. **Jack.**

Eighty-five photographs taken by Major E. M. Jack, R.E., on the Anglo-German-Belgian Boundary Commission in East Africa, 1911.

The expedition during which these photographs were taken was described by Major Jack in the *Geographical Journal* for June, 1913. They are an interesting set of prints, measuring 3½ by 4½ inches.

(1) The British Commission; (2) British, Belgian, and German Commissions; (3) British and Belgian Commissions; (4) British and German Commissions; (5) British, Belgian, and German Askari; (6) Boundary pillar on Anglo-German frontier; (7) Lakes Mugisha, Chahafi, etc.; (8) Wanyamunda people; (9) Safari; (10) Safari in Ankole; (11) Safari arriving at rest house; (12 and 13) Hima cattle; (14) Bridge on Mbarara road; (15) Mumusa with retainers and native levies; (16) A Mtusi chief and followers; (17) Bahima; (18) Boundary pillar on Mount Nkabwa; (19) Nkabwa beacon; (20) Interior of village in Rukiga; (21) A swamp in Rukiga; (22) Village and swamp in Rukiga; (23) River in Rukiga; (24) Marsh in Rukiga; (25) Scene in Rukiga; (26) Western escarpment, Rukiga; (27) Mukiga; (28) Mukiga clothed in banana leaves; (29) Rukiga women working; (30) Mukiga carrying bow and arrows, spears, and sickle; (31) Bakiga; (32 and 33) Lake Mutanda; (34) Lake Muanga; (35) The Kabo (Ruchuru) valley; (36) Bridge across river Kabo (Ruchuru); (37) Kigezi; (38) Kiduha camp; (39) A Muhutu; (40 and 41) Bahutu; (42) Bahutu using hoe; (43) A Bahutu village; (44 and 45) Batusi; (46) A Matwa; (47) Cone crater in Bufumbira; (48) Distant view of Mufumbiro; (49) The Mufumbiro range;

(50 and 51) The volcanoes; (52) Mounts Muhavura, Mgahinga, and Sabinio; (53 and 54) Muhavura; (55) Muhavura with Mgahinga crater in foreground; (56) Boundary pillar near Muhavura; (57) Taking over Muhavura post; (58 and 59) Mgahinga crater; (60) Mount Sabinio; (61) Sabinio, Karisimbi, and Mikeno; (62) Getting sheep across the river; (63) Food store in forest; (64) A path in the bamboo forest; (65) Crossing a river; (66) Iron smelting; (67) Chief waiting to pay visit on a European in Uganda; (68) Rajput signallers; (69) Lava-flows near Nina Gongo; (70) Busuenda; (71) Lava plain north of Lake Kivu; (72 and 73) Lake Kivu; (74) Belgian station of Ngoma, Lake Kivu; (75) A dead lion; (76) Oribi; (77) Mpala; (78) Zebra; (79) Topi; (80) Crested cranes; (81) Sitatunga; (82) Eland; (83) Roan antelope; (84) Buffalo; (85) Young chimpanzee.

Peru and Bolivia. **Nanson.**

One hundred and seventy-one photographs taken during the Peru-Bolivia Boundary Survey by Captain M. R. C. Nanson, R.A. *Presented by the Peru-Bolivia Boundary Commission.*

A set measuring 3¼ by 4¼ inches. Captain Nanson was one of the surveyors attached to the Peruvian Commission for demarcating the boundary between Peru country and Bolivia, under the command of the late Captain H. S. Toppin. As evidenced by this excellent set, he has made good use of the opportunities afforded for photography. Several views are joined as panoramas.

(1) Cavalry in the Plaza de Armas, Lima; (2) On the bridge over the Rio Rimac, Lima; (3) On the border of China town, Lima; (4) Street scene in Lima; (5) Near the market, Lima; (6) Donkeys carrying firewood, Lima; (7) Typical Peruvian coast scenery near Lobitos; (8–11) Lobitos oil-fields; (12) Market-place, Arequipa; (13 and 14) Juliaca market; (15) Calapuja railway station; (16) The frontier peak of Yagua Yagua from the south; (17) The summit of the frontier peak of Yagua Yagua; (18) Climbing Yagua Yagua; (19) Matchu Suchi Cuchi and Suches basin; (20) At the head of Suches lake, the glacier and basin; (21) Head of Suches lake and Nevada Matchu Suchi Cuchi from the west; (22) Plane-tabling by Suches lake; (23 and 24) Suches church; (25) Suches house and mining dump; (26) A troup of llamas carrying maize near Rio Suches, in the Cordillera; (27) A spur of Palomani Tranca from the head of Suches lake; (28) Palomani Grande, 18,926 feet, and Palomani Tranca, 18,482 feet; (29) Palomani Grande from south-west; (30) Sierra Uyacaya from the west; (31) From the Sina pass looking north; (32) North of the Cordillera looking down the Sina valley; (33) Looking north from high ground west of Sina pass; (34) With the plane-table in the Cordillera near the Sina pass; (35) A fall in the Sina valley; (36) Typical Peruvian Cordillera scenery near the Sina pass; (37) Northern slopes of Callejon from west of Sina valley; (38) Glacier south of Callejon; (39) Hills east of Cololo lake; (40) From hills south of Pampa looking east towards Lago Trapichi; (41) From the hills south of Poto looking west, Peruvian Cordillera; (42) Nevadas of Chupi Orco from the south-west; (43) Saqui Apacheta; (44 and 45) Camp at Saqui Apacheta; (46) Cooking arrangements, Saqui Apacheta; (47) Loading up at Saqui Apacheta; (48) Lieut.-Colonel A. J. Woodroffe, R.E., at Saqui Apacheta: (49) With the plane-table in the Cordillera, south of Poto; (50) Peruvian Cordillera, a frontier family; (51) Authorities for place-names at Cohatta; (52) Local knowledge at Cohatta; (53) Arrieros making up loads; (54) Arrieros loading up in Cohatta; (55 and 56) Indian music at Cohatta; (57) Alpacas on Cohatta pampa; (58) Shepherd's house and kraal on the pampa; (59) Alpacas grazing on the pampa near Huarachani; (60) Officers, British and Peruvian—a halt for lunch; (61) A halt on the pampa, about 15,500 feet; (62) The Ginca of Huasacona; (63) Church belonging to an Indian Ginca; (64) Indian church at Muñani; (65) An Indian Ginca; (66) Church built of sun-dried bricks and galvanized iron on the pampa near Pucara; (67 and 68) Andean north-east slope, about 10,000 feet; (69 and 70) The Andean north-east slope, where bush begins at about 10,000; (71) The mossy bush at 10,000 feet, Andean north-east slope; (72) Andean north-east slope—the daily advance of mist and cloud; (73) The source of the Rio Lanza; (74) Bush camp at 10,000 feet near Rio Lanza source; (75) Erecting a signal near the source of the Lanza; (76) Quechua Indians as carriers on the frontier near the Lanza sources; (77) Quechua Indian as cargadores on the frontier; (78) Inca road still used which descends to the Rio Pablobamba; (79) Dr. Aubry on an old Inca road to the Rio Pablobamba; (80) A bush camp at 10,000 feet; (81) Indian carriers resting; (82) The mossy bush at 10,000 feet; (83) Quechua Indians at work on a signal; (84) A village crucifix; (85) Quechua Indian woman with llamas and child; (86) Peruvian gendarmes opening beer, Sandia valley; (87) Sandia mules, which carry only 100 lbs.; (88 and 89) The Sandia pass;

(90) Part of the road from Sandia to the Rio Huari-Huari; (91) Rio Sandia, old river-banks; (92) The signal on trigonometrical station 49; (93) Quechua Indians of Sandia on the road; (94) Pelechuco pass, east side; (95) The town of Pelechuco; (96) The church and plaza at Pelechuco; (97) A camp site on the road from Queara to Mojos; (98) Mules and Indian arriero on the road from Queara to Mojos; (99) At San Juan near Buturo, Capitaz and Quechua Indians from Sandia preparing chuño de platanas; (100) Quechua carriers returning from trigonometrical station on Mosahuaico; (101) Camp on summit of Mosahuaico, about 10,000 feet; (102) On the road to a trigonometrical station, climbing Mosahuaico; (103) Quechua Indians of Sandia carrying cargo up Mosahuaico; (104) Wind-sheltered camp site on summit of Mosahuaico; (105) A Capitz and two servants of the commission fording the Rio Mojos; (106) Rio Tambopata between San Carlos and Marte from the T.R.S. trail; (107) Rio Tambopata near Marte; (108) Rio Tambopata between San Carlos and Marte, near confluence of the Rio Cajones; (109) The continuous land-slide near San Carlos, Rio Tambopata; (110) A signal used on trigonometrical station 50, at the source of the Rio Heath; (111) The chapel, garden, and bell-tower of the Ginca of Wassacona; (112 and 113) The Rio Tambopata between San Carlos and Marte; (114) Rio Tambopata near mouth of Rio Cajones between Marte and San Carlos; (115) Road of the T.R.S. below San Carlos; (116 and 117) Foot of a continuous land-slide near San Carlos, Rio Tambopata; (118) Island in Rio Tambopata near the Marte base-line; (119) Preparing the ground for base measurement, Marte; (120) Quechua Indians employed in preparing a base-line at Marte; (121) Work on Martebase-line; (122) At a trigonometrical clearing near Marte; (123) The trail to trigonometrical station 50 along the Rio Bogillas; (124) Ascent of trigonometrical station 50 at the source of Rio Heath; (125) Poles of pajaron wood for balsa construction; (126) Peruvian servants of the Boundary Commission employed in river work; (127) House of Ichoja Indians, Rio Tambopata; (128) A small balsa on the Rio Tambopata at San Carlos; (129) A laden balsa on the Rio Tambopata, Lieut. Moores, R.E., on board; (130) The launch of a balsa or raft laden with bark lashings; (131) Construction of a balsa or raft from pajaron wood, Rio Tambopata; (132) Ichoja Indians of the Tambopata in garments of civilization near Astillero; (133) Commandante Salavery addressing the T.R.S. balseros; (134) Descending Rio Tambopata from Marte to Astillero; (135 and 136) Descent of Rio Tambopata in balsa; (137) Captain Toppin and Lieut. Moores meet a hunting party of Ichoja Indians with bows and arrows, Rio Tambopata; (138) Construction of balsas at Marte; (139) Dr. Gomez de la Torre greeting a Tambopata Guarayo at Marte; (140) Employées of the Commission practising river navigation; (141) Pajaron wood for balsa construction; (142) Captain Nanson's balsa preparing to start, Rio Tambopata; (143) Descent of Rio Tambopata in balsa—a rest in a back-water; (244) Dr. Gomez de la Torre treating Quechua carriers; (145) Group at the barraca at Marte; (146) Rubber in the barraca of the Tambopata Rubber Syndicate at Marte; (147–149) Rubber and rubber pickers at the Marte barraca; (150) Rubber pickers drying yuca for food at Marte barraca; (151 and 152) Guarayo Indians of the Heath-Tambopata region; (153 and 154) Guarayo youths of the Heath-Tambopata region; (155) Indian woman and child of the Peruvian montaña; (156) A Quechua house servant, Peruvian Cordillera; (157) Quechua Indians employed by T.R.S., Tambopata; (158) Quechua Indian of the Sandia province; (159) Quechua Indian from Moqua-Moqua; (160) Leader of a party of Tambopata Guarayos "Kway" tribe or family; (161 and 162) Tambopata Guarayos "Kway" tribe or family; (163) Tambopata Guarayo youths; (164) Typical barraca of the rubber industry in the Acre region; (165–167) The frontier "trocha" or cutting through the bush in the Acre region; (168) A caouchouc tree felled, tapped, and rotting; (169) Panorama of frontier peaks from west side of Sina pass; (170) Looking east through the Pulechuco pass from high ground east of Suches; (171) The Nevadas to the south, from Yagua-Yagua.

N.B.—It would greatly add to the value of the collection of Photographs which have been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.

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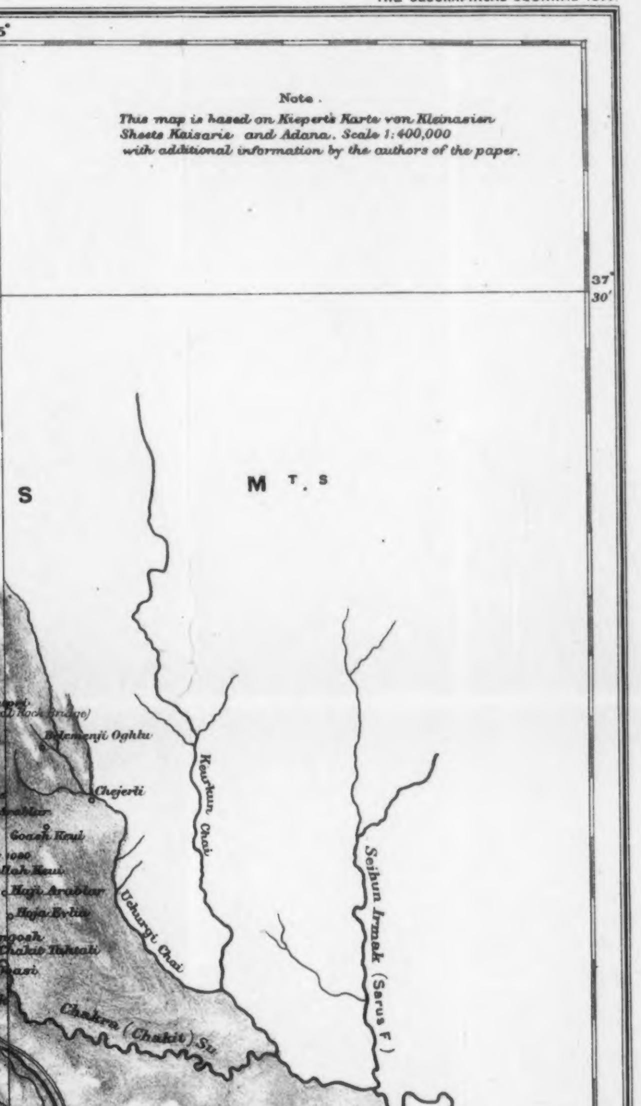

BAGHDAD RAILWAY.
NEWCOMBE & GREIG.

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